The Electrical Industry's Weekly Magazine

March 19, 1956

Electrical World

Price 35 Cents

A McGraw-Hill Publication

THE ALL-ELECTRIC HOME

An Electrical World report on its characteristics and of some of its component loads

PAGE 123

ALLIS-CHALMERS

Originators of 5/8% Step Voltage Regulators

Here's the Answer to Changing System Loads

Vari-Amp feature on single-phase power regulators lets you match unit to your needs

Five Current Ratings—25 Regulating Combinations —in a Single Regulator. That's what you get in Allis-Chalmers single-phase power regulators. Like all Allis-Chalmers voltage regulators, these units are equipped with the *Vari-Amp* feature to provide for increasing current capacity by reducing the range of regulation.

Unequal Ranges Possible

Further, it's possible to utilize unequal range of regulation to meet your system's exact *needs*. Here's an example: you can set for 6¼% range in the raise direction with 160% capacity, 10% range in the lower direction with 100% capacity.

25 REGULATING COMBINATIONS

This regulator equipped with

Vari-Amp Feature

ALLIS-CHALMERS

Only Allis-Chalmers voltage regulators provide the unique *Vari-Amp* feature with so many possibilities for matching a regulator to your system's exact requirements. Get the full story. Call your nearby A-C office. Or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-4899

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

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Electrical World

Published for 82 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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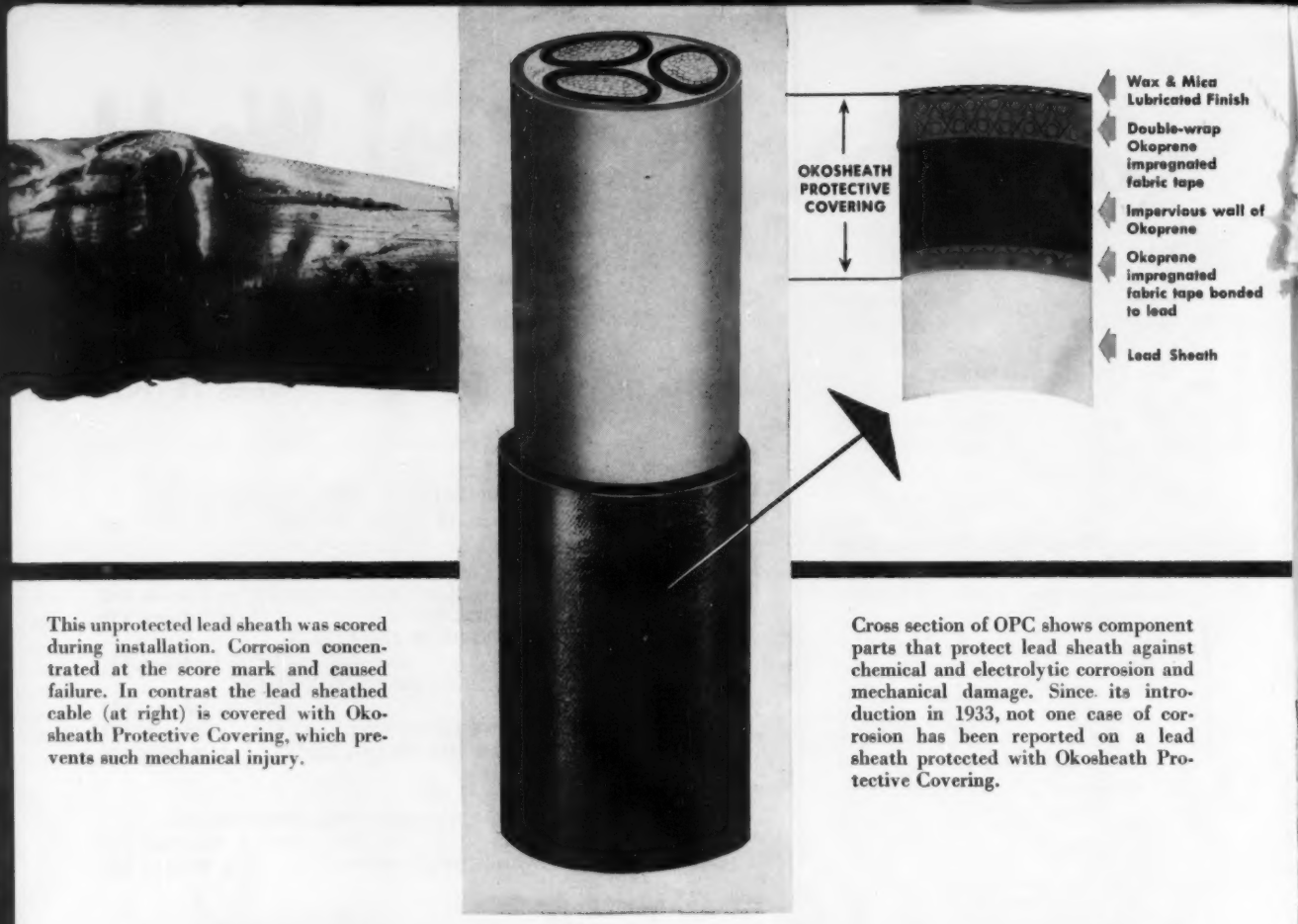


This unprotected lead sheath was scored during installation. Corrosion concentrated at the score mark and caused failure. In contrast the lead sheathed cable (at right) is covered with Okosheath Protective Covering, which prevents such mechanical injury.

Cross section of OPC shows component parts that protect lead sheath against chemical and electrolytic corrosion and mechanical damage. Since its introduction in 1933, not one case of corrosion has been reported on a lead sheath protected with Okosheath Protective Covering.

why Okosheath Protective Covering *eliminates lead sheath failure caused by scoring and corrosion*

Service records dating back to 1933 prove that Okosheath Protective Covering prolongs the life of paper-insulated lead sheathed cables for three main reasons.

1. Eliminates chemical corrosion—the substantial wall of Okoprene, free from fibrous materials that can wick-in moisture, is completely vulcanized and meets all the ASTM requirements for neoprene cable coverings. Okoprene provides excellent resistance to alkalies and acids in the soil. Firmly bonded by vulcanization to the sheath, it prevents any corrosive elements from contacting the lead and causing corrosion.

2. Stops electrolytic damage—the dense, homogeneous wall of Okoprene possesses stable electrical insulating properties which prevent electrolysis caused by stray currents. It is applied by Okonite's well-known strip-insulating process which assures a uniform wall thickness with no thin spots over the lead sheath.

3. Prevents scoring of lead—because unprotected lead sheathed cable is vulnerable to scoring from abrasion during installation, its ability to resist internal pressure is greatly reduced. In tests, lead pipe sections having controlled score marks of 10% and 15% of their average thickness and subjected to internal pressure broke 17% and 31% sooner, respectively, than unscored pipes of identical thickness. The composite reinforced wall of Okosheath Protective Covering eliminates this possibility of mechanical damage to the lead sheath. In addition, pulling problems are reduced because the two outer layers of heavy fabric tape are slushed with a wax and mica finish.

For additional information on Okosheath Protective Covering write for Bulletin EW 1047, **Address: The Okonite Company, Passaic, N. J.**

available with either copper or aluminum conductors

3912

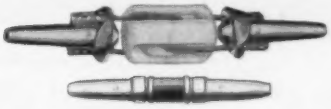
OKONITE insulated cables

for the largest number of line applications, at the lowest possible cost . . .

Electroline Products

Practical experience designed these Electroline Products; and a practical habit of keeping close tab on costs has established them as first in the field—for top quality and economical performance.

ELECTROLINE SECTIONALIZERS

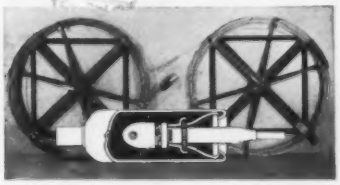


Insulating automatic line splice sectionalizers:

- simplify cutting-in of regulating equipment — disconnecting points, fuses, voltage regulators, series capacitors, etc.
- to provide points to test for trouble
- for sectionalizing networks—to isolate and test area in trouble
- series street lighting—simplifies cutting-in series lamps

Bulletins contain complete information.

DUCT-RODDING EQUIPMENT



Light in weight, feeds easily around bends, easy to handle. Electroline Steel Duct-Rodding Equipment has an extraordinary record for high efficiency at lowest cost. A big money-saver —cuts labor cost, original cost and total investment.

A four-page illustrated brochure gives full information.

AUTOMATIC LINE SPLICES

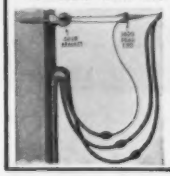
It is well said of these simple, rugged units—"They go on in no time; they hang on for all time." Easy to install—and their mechanical strength exceeds the rated breaking strength of the conductors. Ideal for restoring service.

AUTOMATIC DEAD-ENDS

In a typical "torture" test for strength, gripping and vibration damping features, 100,125,000 recorded vibrations did not develop any sign of failure of conductor in these rugged dependable Dead-Ends. Engineers call it equivalent to 50 years of ordinary service.

Electroline Service-Drop Automatic Dead End. The "3800" Series for holding pre-assembled service cable using a bare neutral conductor as the messenger.

The method of gripping the bare neutral employed by this ELECTROLINE Anchorage eliminates the danger of short circuiting the phase wires so common with the use of concentric cable clamps.



ELECTROLINE Service-Drop Anchor Bracket. The "4000" Series for securely supporting the cable at any angle.

Electroline Company

4121 So. LaSalle St., Chicago 9, Ill. *In Canada:* **POWERLITE DEVICES, LTD., TORONTO**

NEW NETWORK Meet Growing

Soon three 1000-kva transformers in vault built for three 450-kva units in 1934

Virginia Electric and Power Company solved a load and a space problem with Allis-Chalmers network transformers.

Wise planning when the vault was originally built now permits use of larger transformers than were initially installed. In fact, even today there is still room for some increase in transformer capacity.

But vaults, at best, are close quarters for maintenance men. This places a premium on dependability.

Here are some of the features of Allis-Chalmers network transformers:

- Thorough undercoating of tubes and base surfaces to protect against corrosion.
- Spiral-wound metallic gaskets—finest sealing of bushings in tank wall. They provide unusual resilience . . . can be installed without cements or grease . . . can be quickly removed if required and may be reused if needed.
- Compact, low-loss design.
- Solder-wiped threaded valve connection to tank.

Widely Used — **Nearly 1½ million kva of these units are in operation across the country. For more information, call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.**

ALLIS-

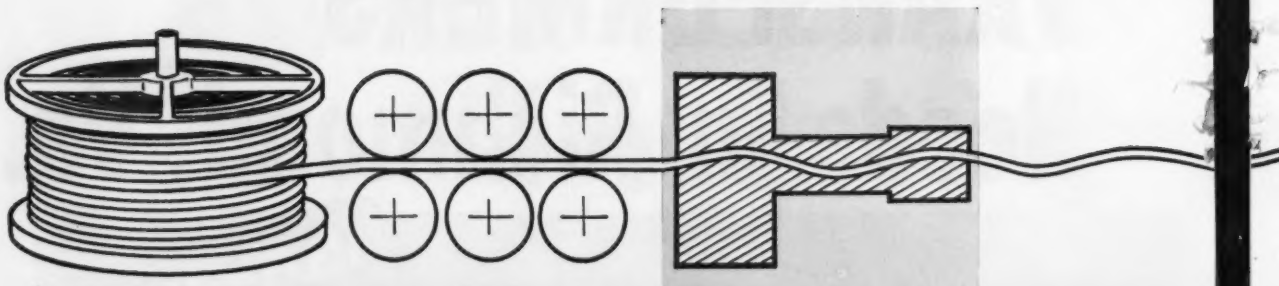
TRANSFORMERS Needs in Richmond, Va.

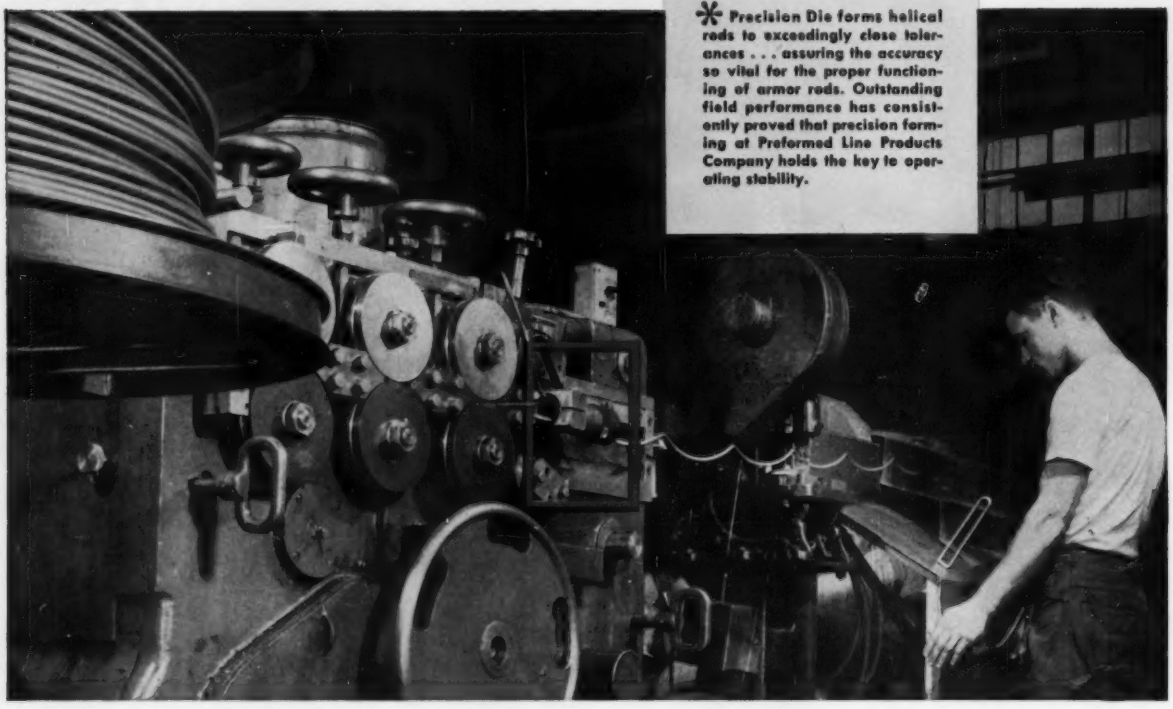
This 1000-kva Allis-Chalmers network transformer is being lowered into Sixth Street sidewalk vault. It is alongside a 750-kva and another 1000-kva Allis-Chalmers transformer.

CHALMERS

A-C ALLIS-CHALMERS

A-4957





✻ Precision Die forms helical rods to exceedingly close tolerances . . . assuring the accuracy so vital for the proper functioning of armor rods. Outstanding field performance has consistently proved that precision forming at Preformed Line Products Company holds the key to operating stability.

✻PRE-FORMING WITH DIES . . . *Symbol of PLP Quality*

One vital element—the exclusive precision die—stands out from all others in the manufacture of Preformed Rods. Designed by Preformed Line Products Company, this special die assures absolute uniformity for all Preformed Products—converting straight rod into dimensionally exact helical rods. That's why one PLP Rod is exactly the same as another of the same size and *why all pitches within each rod are precisely the same.*

Precision-formed rods that have passed rigid quality controls mean added trouble-free performance to the user from installation to long service life. It reflects the care exercised all along the line to assure that every PLP Product meets the exacting specifications developed and constantly checked in the laboratories of Preformed Line Products Company.

Let us give you more information on their advantages; ask your local PLP Representative.

Made in accordance with or for use under one or more of the following U.S. Patents:
2,275,019; 2,587,521; 2,609,653; 2,691,865; other patents pending.

PREFORMED LINE PRODUCTS COMPANY
5349 ST. CLAIR AVENUE, CLEVELAND 3, OHIO
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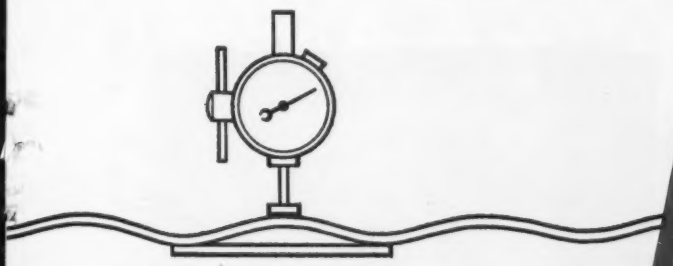

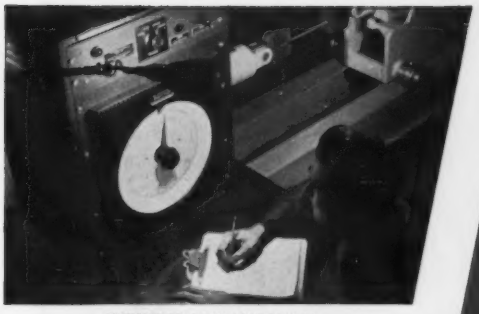

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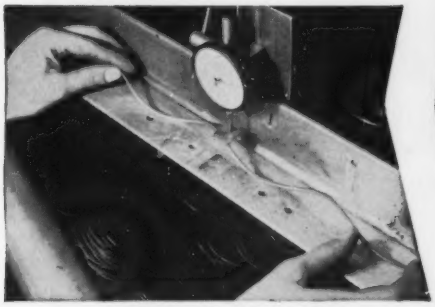
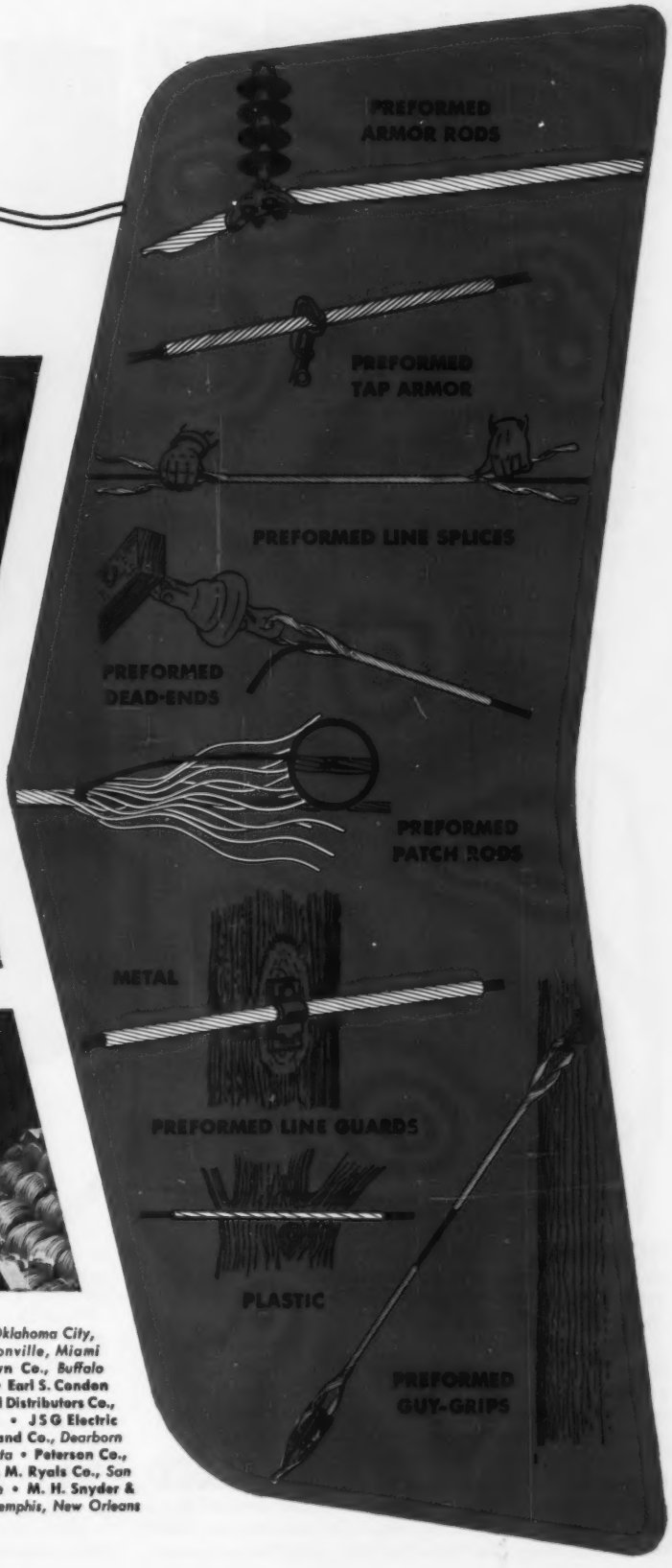


CHECKING PREFORMED RODS

PACKING PREFORMED RODS



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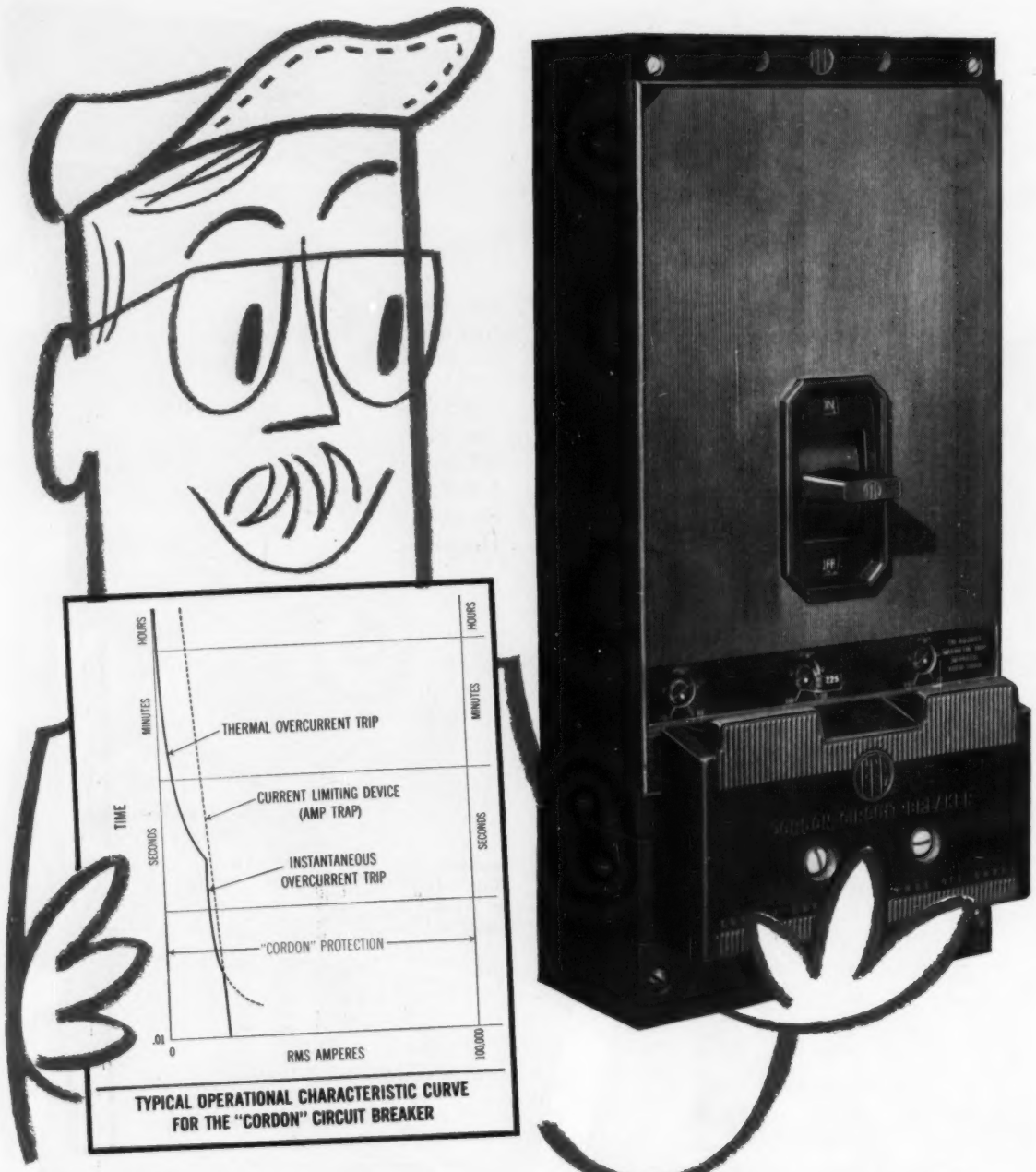


TYPICAL OPERATIONAL CHARACTERISTIC CURVE FOR THE "CORDON" CIRCUIT BREAKER

HOW IT WORKS: Combining and coordinating standard circuit breaker characteristics with specially designed current limiting Amp-traps, the "Cordon" circuit breaker achieves the characteristics shown above.

The thermal, magnetic trip unit provides coordinated protection against overloads and short circuits up to a predetermined value. At this point the current limiting Amp-traps assume the fault-clearing duty and extend short circuit protection to 100,000 rms amperes.

Therefore, unless the magnitude of a short circuit reaches the fusing point, the Amp-traps are unaffected, and the standard circuit breaker overload devices perform their normal function. Since the fast clearing time of the Amp-trap (less than ½ cycle) provides a current limiting effect, the magnetic and thermal stresses, which are proportional to the square of the current, are greatly reduced. Consequently, the standard molded case type circuit breaker safely withstands the heavy fault current, and the necessity of designing structures for maximum available short circuits is eliminated.

The Amp-traps are mounted in a molded housing which plugs into the load side of the breaker forming one compact unit. A design feature of the "Cordon" circuit breaker actuates a common tripper bar when any Amp-trap blows, opening all poles of the circuit breaker. Until the blown Amp-trap is replaced the circuit breaker cannot be closed. A mechanical linkage arrangement automatically opens the circuit breaker when the Amp-trap housing is removed.

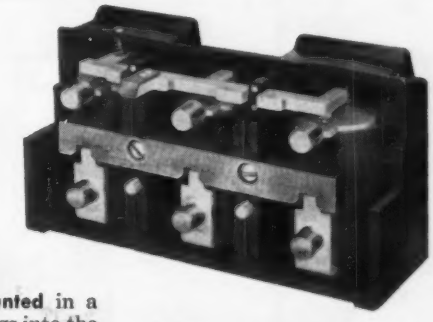
New I-T-E "CORDON" Circuit Breaker

100,000 amp interrupting rating in molded case circuit breakers

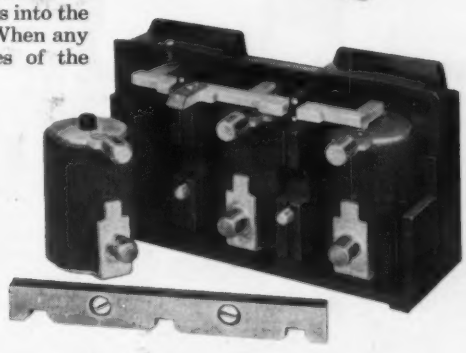
Now—one compact circuit breaker provides the practical, economical solution to meet constantly increasing interrupting requirements. The new "Cordon" circuit breaker provides all of the design and operating advantages of the famed I-T-E molded case breaker, plus interrupting ability up to 100,000 rms amperes.

The "Cordon" circuit breaker can be utilized in normal branch and feeder circuit applications in switchboards, panelboards, load centers, and individual enclosures. Plug-in mounting, rear connected studs, or front connected terminal mounting arrangements are optional.

"Cordon" circuit breakers are available with 2 or 3-pole construction in 100, 225, 400 and 600 ampere frame sizes, 250 v d-c and 600 v a-c. Write for complete details or call your nearest I-T-E office. I-T-E Circuit Breaker Company, Small Air Circuit Breaker Division, 19th & Hamilton Sts., Phila. 30, Pa.



The Amp-traps are mounted in a molded housing which plugs into the load side of the breaker. When any Amp-trap blows, all poles of the breaker are opened.



Draw-out design feature of Amp-trap housing provides accessibility to simplify change of Amp-trap. Amp-trap stud design assures proper alignment and positive connection when inserted in the breaker frame.

To replace a blown Amp-trap (indicated by released plunger) you simply loosen two screws, remove the retaining bar, withdraw the blown unit, insert the new one, and replace the retaining bar.

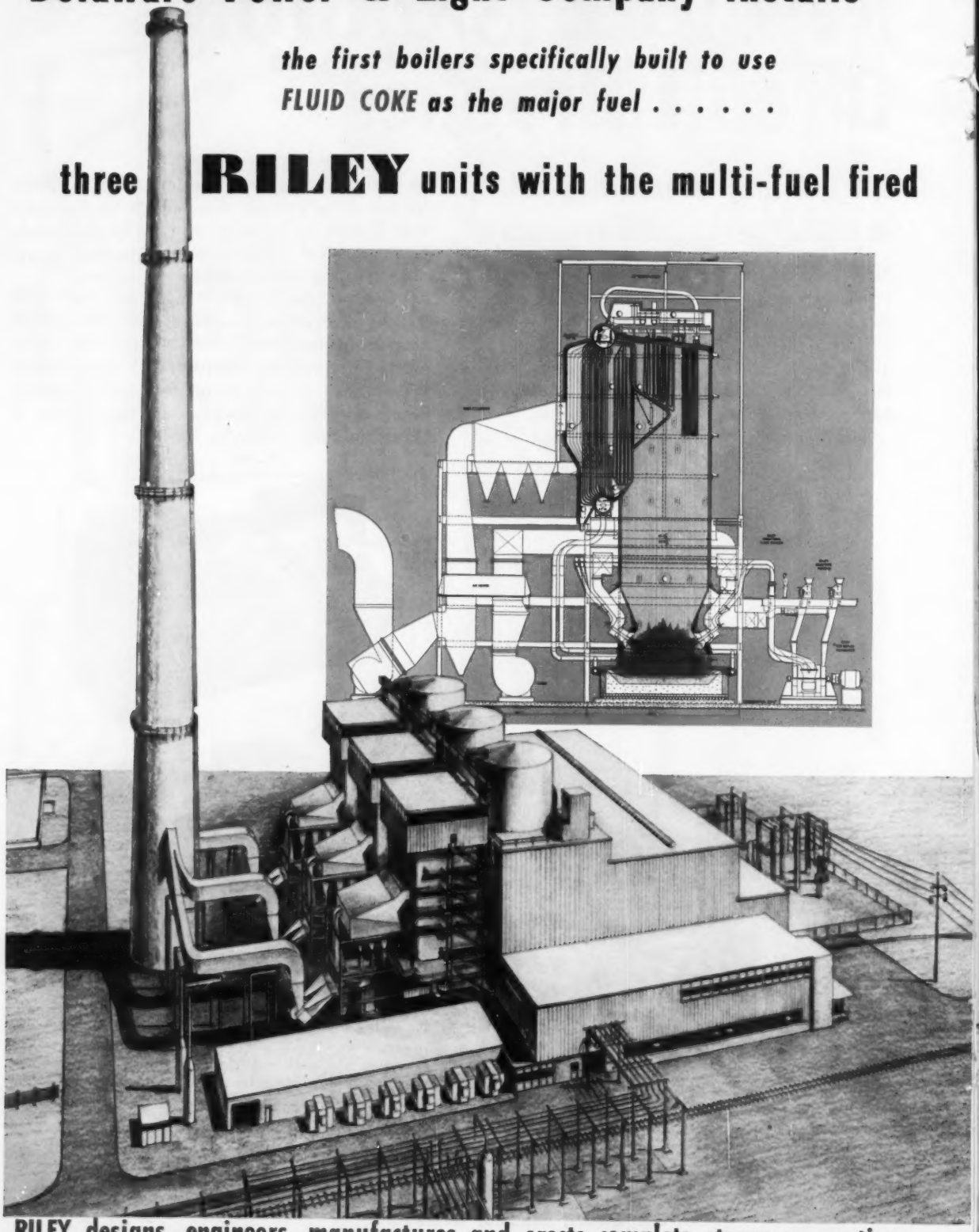
I-T-E CIRCUIT BREAKER COMPANY

Small Air Circuit Breaker Division

Delaware Power & Light Company installs

the first boilers specifically built to use
FLUID COKE as the major fuel . . . . . .

three RILEY units with the multi-fuel fired



RILEY designs, engineers, manufactures and erects complete steam generating

TURBO FURNACE

Delaware Power & Light Company selected three Riley TURBO FURNACE units for its Delaware City Power Station which will supply steam and electric power requirements of Tide Water Associated Oil Company's new 130,000 barrel-per-day Flying "A" Refinery in Delaware. These units were designed particularly for efficiently firing fluid coke with a minimum of auxiliary fuel.

To burn low volatile fluid coke a furnace providing high heat concentration, high turbulence and sufficient residence time for burnout is necessary . . . and Riley's TURBO FURNACE meets these requirements. The coke, pulverized by Riley Mills, is introduced into the furnace combustion chamber by Riley Directional Flame Intertube Burners arranged for opposed firing. Fluid Coke is largely carbon; therefore, a reinjection system is used to burn the catch in the dust collection system. The design of the burners and the TURBO FURNACE will also permit the burning of refinery gas, oil and coal.

C. F. Braun & Co — Engineers and Constructors

ADVANTAGES of RILEY TURBO FURNACES

- Efficiently uses a wide range of coals, oil, natural and refinery gases, fluid coke, delayed coke, lignite.
- Lower carbon loss, higher efficiency
- No slag blowers required
- No stratification of furnace gases
- No fly ash disposal problem
- All burners on one level
- The same furnace exit gas temperatures with all fuels
- No change is needed in pressure parts regardless of fuels
- Lower overall height

DELAWARE CITY POWER STATION
Three Riley TURBO FURNACE Units
Steam Capacity — Each 500,000 lbs/hr.
Design Pressure — 1425 psig
Steam Temperature — 950 F.
Fired by Riley Mills

A survey of your plant by a consulting engineer could show ways of making surprising savings in your power costs.

RILEY
Stoker Corporation
WORCESTER, MASSACHUSETTS

Sales Offices: Worcester, New York, Philadelphia, Buffalo, Washington, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Houston, Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle.

units for Public Utility Central Stations and Industrial Power and Heating Plants

malleable iron lengthens life of pole hardware *without increasing cost!*

MIF high corrosion resistant malleable iron pole hardware costs no more—and often less—than mild steel . . . and far less than special, low alloy, premium priced steel hardware.

Write for further information about MIF Longer Life pole hardware.

MALLEABLE IRON FITTINGS COMPANY

POLE HARDWARE DIVISION

Branford, Connecticut

MIF

Canadian Mfr. & Dist.: LINE & CABLE ACCESSORIES, Ltd. TORONTO

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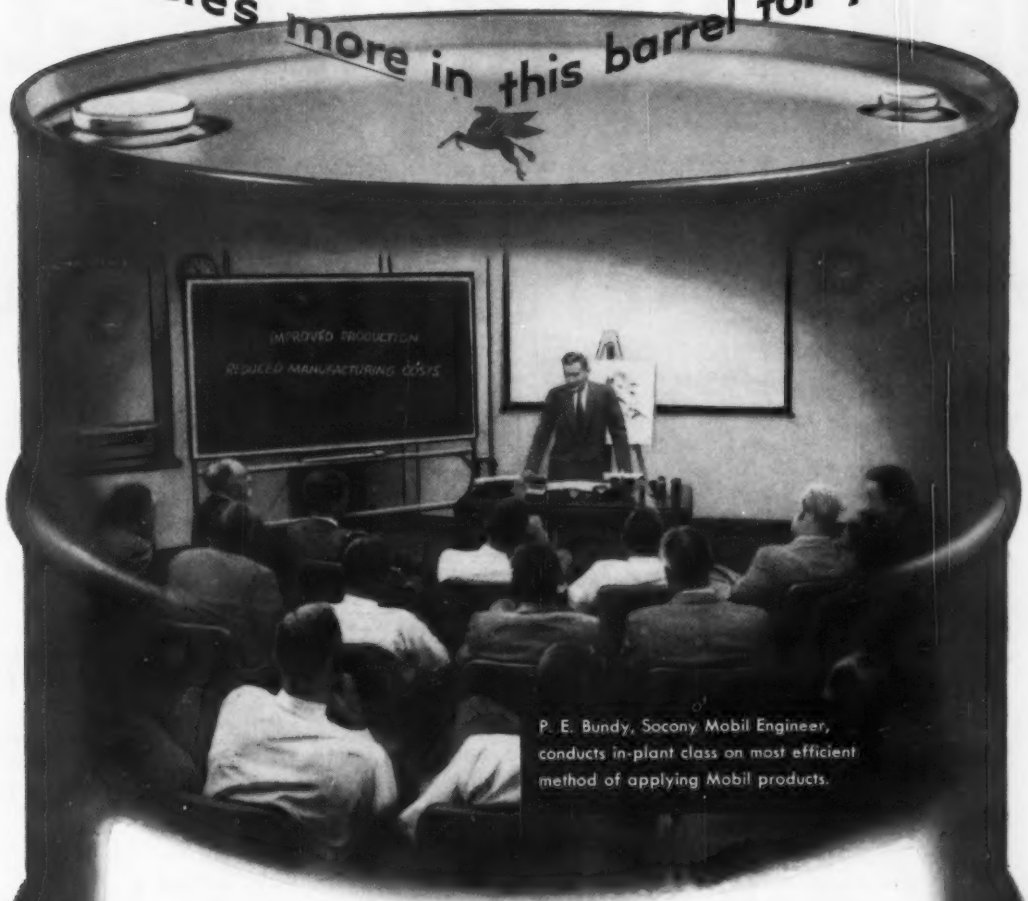
There's more in this barrel for you...



P. E. Bundy, Socony Mobil Engineer, conducts in-plant class on most efficient method of applying Mobil products.

MORE IN-PLANT TRAINING

to help you improve production and cut costs!

With Socony Mobil petroleum products we offer you more in-plant training courses and seminars than any other oil company. Lubrication experts instruct your personnel in the most efficient, most economical methods of applying and using our products. This thorough training eliminates over-use and waste—helps improve your production and lower your unit costs.

Socony Mobil products are also backed by *more* field engineers serving industry . . . *more* continuous research to assure continually improved products . . . *more* services for analyzing petroleum products in use . . . *more* approvals from machine builders . . . *more* practical experience—90 years!

Always specify Socony Mobil. There's *more* in every barrel for you!

SPECIFY **SOCONY MOBIL**

FIRST STEP IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY
GENERAL PETROLEUM CORPORATION

LUBRICANTS • FUELS • CUTTING FLUIDS • WAXES • SOLVENTS • PLASTICIZERS • PETROCHEMICALS

NEW SUPERCHARGED

developed by Foster Wheeler

offers FIVE IMPORTANT

FOSTER WHEELER has developed a new supercharged boiler of far-reaching significance to the power industry.

In the supercharged cycle, diagrammed schematically on the facing page, high pressure combustion gases leaving the boiler are used to drive a gas turbine which, in turn, compresses combustion air for the boiler and drives an auxiliary generator. Spent gases from the turbine pass through an economizer and thence to the stack.

The following advantages are inherent in this supercharged boiler cycle.

1. There is a marked increase in overall plant economy. When utilizing maximum gas turbine operating temperatures, net power developed by the gas turbine can run as high as 15% of total plant output, with an overall gain of 10% in cycle economy. Even when operating at lower exit-gas temperatures, where the gas turbine is used only to drive the compressor, cycle economy is increased by the amount of power that would otherwise be required for operating the fans of a conventional boiler.

2. The supercharged boiler permits a rather astounding reduction in size and weight, due to much higher heat absorption rates. A supercharged boiler may weigh from ½ to ¼ as much as a conventional boiler of equivalent capacity. This, of course, permits a substantial saving in first cost—as much as 25% or more, depending on cycle conditions.

3. Start-up time is extremely short compared to that of a conventional steam generator.

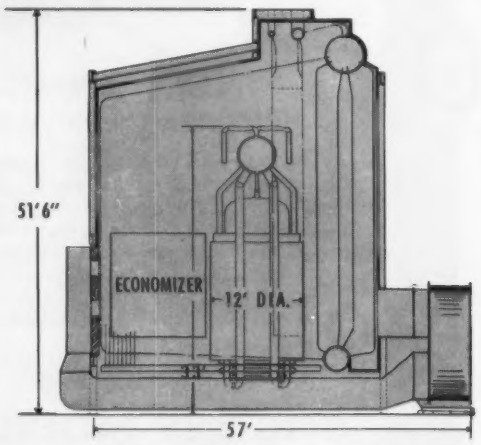
4. The supercharged boiler responds much more quickly to load changes.

5. Boilers can be completely shop fabricated and shipped ready to install.

To obtain the design symmetry essential for this pressurized firing service, the boiler drum is mounted separately above the boiler furnace—connected to it by external risers and downcomers. The furnace is fully enclosed with waterwall surface and a metal baffle separates the furnace tubes from the convection section. Superheated pancake coils are located in the base of the firing chamber.

Foster Wheeler has built three of these supercharged boilers and a fourth is now under construction. At present, units can be furnished for natural gas or light fuel firing.

For complete information on this important Foster Wheeler development, send for a copy of the December issue of "Heat Engineering". *Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.*



Comparison of physical dimensions of a conventional boiler (gray) and supercharged boiler (red). Both units are designed to furnish steam at 1200 psi, 950F for a 43,000 kw station.

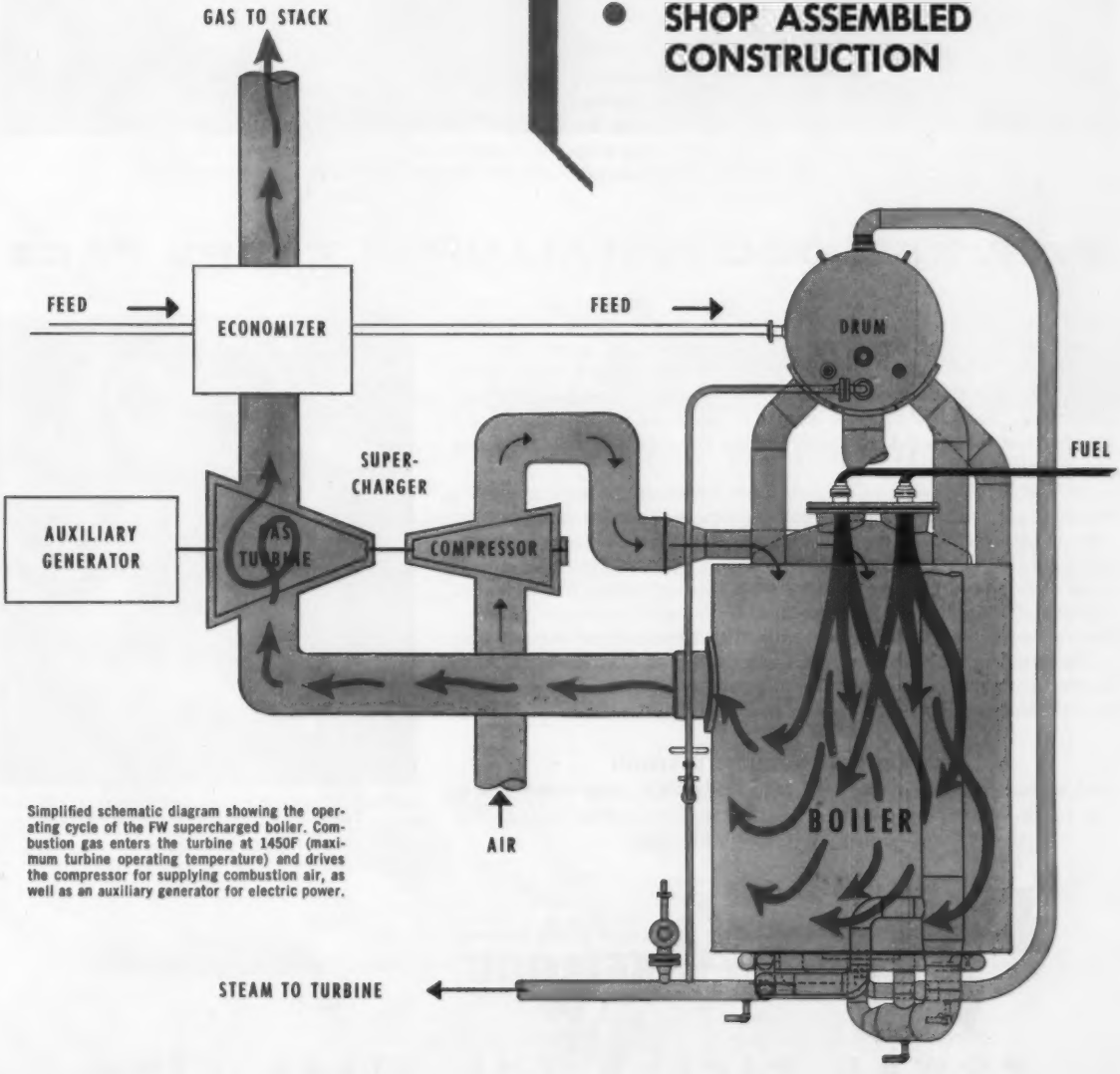
FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

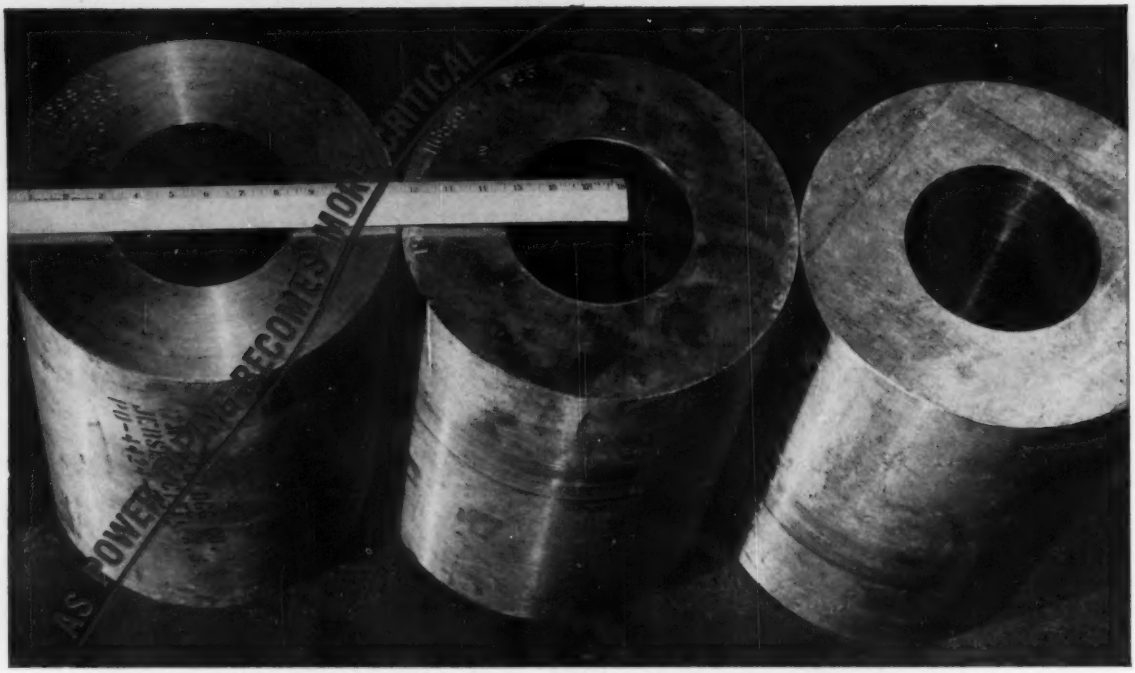
BOILER

ADVANTAGES...

- HIGH OVERALL ECONOMY
- DRASTIC REDUCTION IN SIZE AND WEIGHT
- SHORT STARTING TIME
- QUICK LOAD RESPONSE
- SHOP ASSEMBLED CONSTRUCTION



Simplified schematic diagram showing the operating cycle of the FW supercharged boiler. Combustion gas enters the turbine at 1450F (maximum turbine operating temperature) and drives the compressor for supplying combustion air, as well as an auxiliary generator for electric power.



Heavy-walled sections of new and existing alloys, most never before used for the purpose, are tested and evaluated by Kellogg toward improving design and performance of main and reheat steam piping.

M. W. KELLOGG METALLURGY KEEPS PACE

With wall thicknesses of main and reheat steam piping for current steam-electric power plants already approaching the upper limits of practicality, supercritical pressures and temperatures present a multiplicity of metallurgical problems to the power piping designer and fabricator. New and stronger stable alloys must be developed, new welding materials found, and new welding techniques and heat treating procedures perfected.

At The M. W. Kellogg Company, new materials containing alloying elements such as molybdenum, cobalt, tungsten, nitrogen, and titanium —in addition to chromium, nickel, and columbium—are now being investigated for long term high pressure service to 1300 deg. F. Most have never before been used for main or reheat steam piping. Heavy-walled sections of these materials are welded, tested, and evaluated by every known technique at Kellogg's Jersey City metallurgical laboratories.

The results of these continuing studies will prove extremely valuable to consulting engineers, engineers of power generating companies, and manufacturers of boilers, turbines, and allied equipment.

Sections of piping are welded, using various materials and techniques, and then tested for strength and other characteristics.

FABRICATED PRODUCTS DIVISION
THE M. W. KELLOGG COMPANY, 225 BROADWAY, NEW YORK 7, N.Y.
The Canadian Kellogg Company, Ltd., Toronto • Kellogg International Corp., London
SUBSIDIARIES OF PULLMAN INCORPORATED

POWER PIPING—THE VITAL LINK

Line construction bodies for light to heavy-duty. Crew compartments optional. Efficient tool compartments and drawers.

Bodies for truck driven air compressors. Designed to accommodate hose reels, tapping machines, jack hammers, etc.

Service bodies for chassis up to 1½ ton. Lengths, 72", 75", 84", 90" and 102".

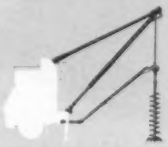
Hydraulic Derricks designed for front or rear mounting. Capacities to 12,000 lbs.

Light-duty power operated derricks for front or rear mounting. Operating range of 146°.

Ladders to 40' with all phases completely hydraulic. Pump actuated by P.T.O. or separate engine drive with electric starter.

Mechanical Ladders expertly engineered and counterbalanced for effortless handling. Maximum heights from 23' to 40'. Swings 360°; angles to 72°.

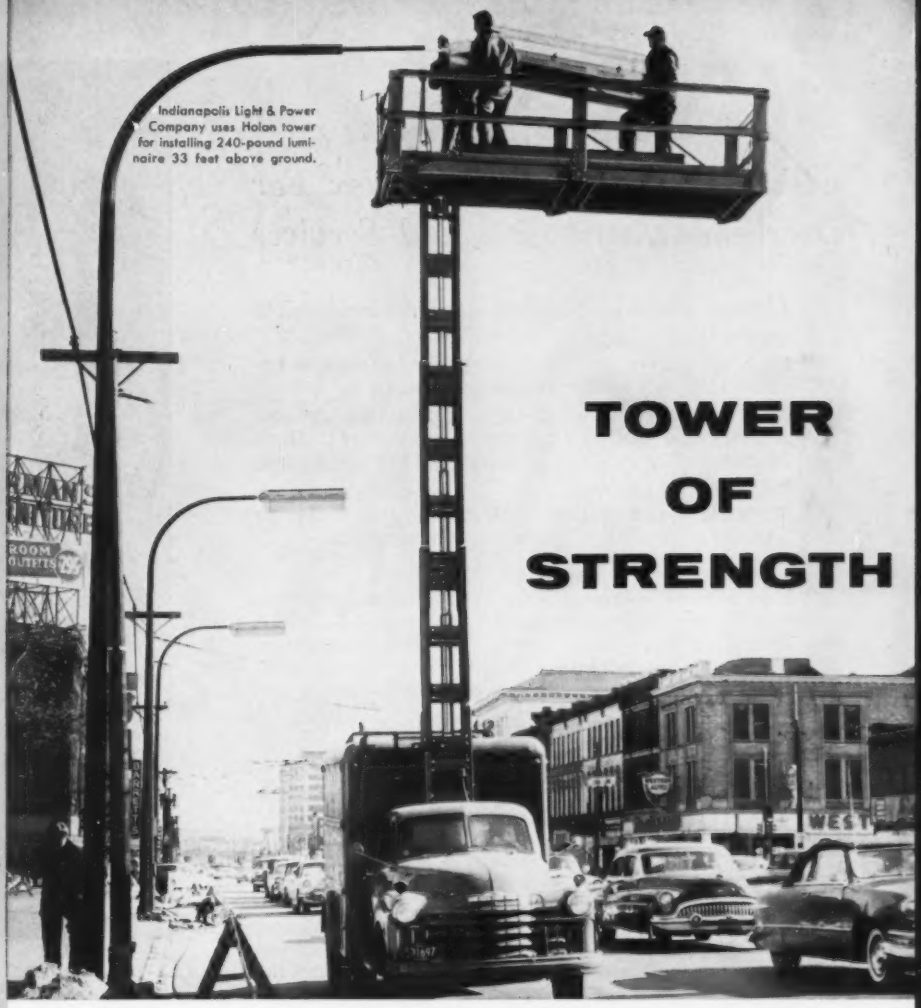
Portable mechanical and hydraulic earth borers with optional rotation.



Wide variety of pole and reel trailers. Standard and special. Many optional features.

Hydraulic jacks, controlled from rear of truck. Rigid mounted or patented Holan self-stowing types.

Hydraulic towers with rotary, stationary, or transverse platforms. Exclusive box-girder telescoping mast.



Indianapolis Light & Power Company uses Holan tower for installing 240-pound luminaire 33 feet above ground.

Holan hydraulic towers make high-up work safe and easy . . . like working on the ground.

A powerful, telescoping double-acting cylinder, supported by a telescoping box section, smoothly lifts the platform into the sky. Every movement of the platform — up or down, around or sideways — is controlled by push-buttons from the platform or the cab.

For crew safety, there's a 3-foot side railing and insulation throughout. All told, you have the last word in convenience, safety, and easy maintenance.

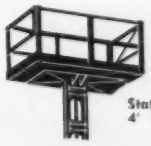
If you work high up, get the low-down on Holan hydraulic towers.

THREE TYPES

Transverse platform — moves laterally, 11 feet* either way. 4' by 7' platform.

*Can be made to move laterally 14 feet for special applications.

Rotary platform — rotates 330°. 4' by 11' platform.



Stationary platform. 4' by 7' platform.

Three models for each type — maximum heights of 17', 23'6" and 30'. Can also be furnished for 35' height. All towers collapse to about 10'3".

J.H. HOLAN® CORPORATION

4100 WEST 150TH STREET
CLEVELAND 11, OHIO

OTHER PLANTS:
HOLAN Thrift Line CORP., Griffin, Georgia • J. H. HOLAN CORP., Phoenix Div., Arizona
BRANTFORD-HOLAN LIMITED, Brantford, Ontario

THE NAME THAT MEANS WORK SIMPLIFICATION

Save 4 ways

with Rome Aluminum Triplex For Overhead Distribution and Services

1. You save on the initial cost . . . as compared to copper triplex.

2. You save time and money on installation because of lighter weight and easier handling.

3. You save on maintenance and service interruptions as compared to open-wire installations. Rome Aluminum Triplex offers maximum resistance to storms, wind and ice loading.

4. You save on pole and crossarm cost by longer spans of triplex self-supporting secondary cable.

Minimum replacement

Insulated with RoPrene (Neoprene) or RoLene (polyethylene) Rome Aluminum Triplex provides greater protection against sunlight, heat, moisture, corrosive atmospheres, abrasion and other operating hazards. There are no braids to rot or festoon. Your replacement costs are minimized.

Better performance

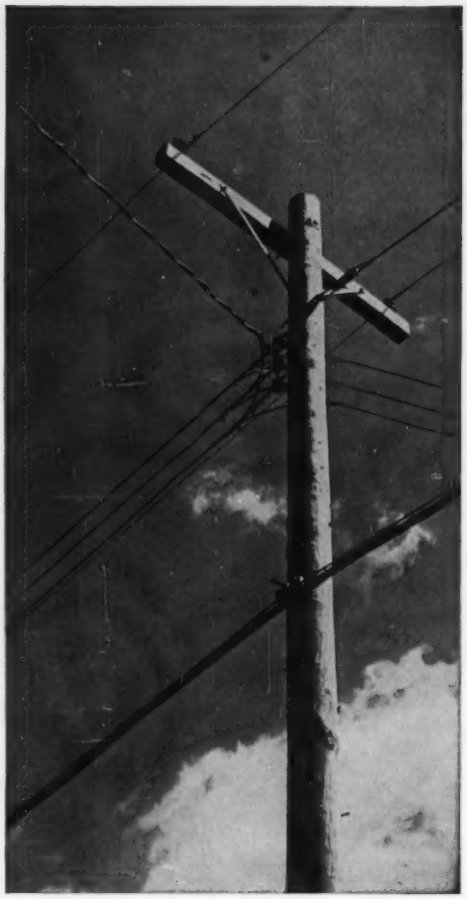
On secondaries you get better voltage regulation because of lower reactance in long and heavily loaded circuits. And, finally, you have a neater, cleaner installation . . . no cluttered, unsightly open wires.

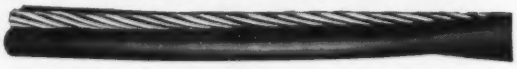
Quality controlled, from pig to finished wire

Rome Cable is one of the few manufacturers of aluminum conductors who are equipped with the famous Properzi continuous casting process. Production begins with the primary aluminum pig which, from molten form, is cast, rolled and drawn into the finished conductor. This basic working of the metal, plus careful, scientific compounding and application of insulating materials, all under one roof, permits Rome to closely control quality of its aluminum products during each phase of manufacture. It is your assurance of uniform dependability.

For full information on Rome Triplex with aluminum (or copper) conductors, send for Rome Bulletin RS-5. It gives specifications, dimensions and includes sag and tension data.

By popular demand • The wide acceptance of triplex cable for overhead services by large utilities, small municipalities, and customers of both, throughout the entire country, is proof of the popular demand of the present, and indicative of the future trend in overhead service cable design.



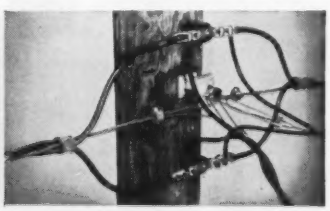


Rome Aluminum Triplex can be purchased in handy 500-foot cartons, paper-wrapped coils or on nonreturnable reels.

Typical service connections

Dead-end connection at house

Fewer poles, longer spans with mid-span taps possible on secondaries



Service tap connection at pole

Rome Aluminum Line Wire

RoPrene (Neoprene) or RoLene (polyethylene) line wires give you extra service life because they are inherently tough. They have exceptional weathering stability and are unaffected by industrial fumes.

Either RoPrene or RoLene aluminum line wires

- resist moisture, sunlight, weathering, corrosive atmospheres and abrasion.
- are nonrotting and nonfestooning
- are smoother, easier to pull over crossarms than conventional weatherproof wires
- are easier to strip and clean for connections

Conductors, aluminum, ACSR (or copper) are manufactured in accordance with the latest ASA and ASTM specifications, as applicable. The RoPrene and RoLene coverings meet ASA specifications for weather-resistant wire.

Rome Bulletins WP-2A and WP-4 give you full information on Rome Aluminum Line Wire (as well as copper and ACSR).

Rome ALUMINUM

Rome Cable Corporation, Rome, New York, and Torrance, California

IT'S HERE the NEW KEYSTONE HDG LADDER MOUNT

Pictured 12" wood strain insulators in truss rods of fly and lower ladders.

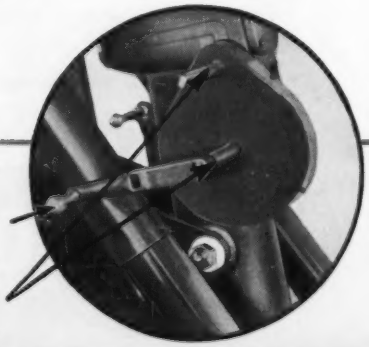
This new mount is the answer to horizontal rotating problems on high crowned roads or inclines.

1. Gear box containing two-speed, self-locking worm gears.
2. Two-throw handle.
3. Hand wheel for raising fly ladder.
4. Eight position lock for vertical raising of entire ladder.
5. Vertical ladder with knurled rungs for safety.

New Keystone HDG Ladder Mount equipped with two-speed, self-locking gears for easier horizontal rotating and 12-inch wooden insulators in truss rods.

The new gear box sealed to permit gears to operate in lubricant.

1. Two-throw handle allows operator to select operating speed desired.
2. Low speed, high torque shaft (top) and high speed, low torque shaft (center) affords easy operation regardless of high crowned, inclined or level road.



ELECTRIC SERVICE MANUFACTURING CO.

The ONLY Mechanical Ladder Easily Operated on High Crowned Roads or Inclines

Two-Speed, Self-Locking Gears Make Easy Horizontal Rotating

HIGH CROWNED OR INCLINED ROADS NO PROBLEM Overcoming one of the greatest difficulties of ladder mounts, that of horizontal positioning on high crowned or inclined roads, was the prime factor in engineering the new Keystone HDG Ladder Mount. Now with the new two-speed self-locking gear-driven Keystone HDG Ladder Mount, one man can easily spot the ladder in infinite number of horizontal positions. No tugging against heavy load due to necessity of parking on an incline.

WHY IS THE HDG EASIER TO OPERATE? With two shafts—low speed with high torque or high speed with a low torque—plus a two-throw handle, permits operator to select gear ratio best suited for operating conditions. With hardly any effort on operator's part, ladder may be spotted or returned to ladder rest with ease.

WHAT MAKES OPERATING SO EASY? Enclosed in a precision machined gear box are double reduction worm gears. Dirt, dust, moisture and other harmful materials are sealed out to give longer gear life. All gears run in a lubricant to reduce friction. Adjustments for better gear operations can be made when necessary by one screw on the outside of the gear box. All this adds up to easier operation, higher efficiency and longer life with minimum maintenance.

SAFETY FIRST, LAST AND ALWAYS Keeping in mind the operator's safety, the Keystone HDG Ladder Mount is ruggedly constructed to prevent deflection, side sway and twisting. New 12″ wooden insulators are now standard equipment in the truss rods of the fly and lower ladders. Metal rungs on the vertical ladder are knurled to prevent slipping. All wooden rungs are backed up by a safety tie bar on the lower side. Ladder locks in any horizontal and eight vertical positions. Handwheel raises and lowers fly ladder eliminating loose rope on the truck floor. A handwheel brake stops or retards descending fly ladder.

COMPACTNESS AND FLEXIBILITY Keystone HDG Ladder Mount can be rotated horizontally through a complete 360 degrees and locked in infinite number of positions. Ladder Mount fits conventional truck chassis and requires a 42″ diameter for mounting purposes. Available in 24, 28 and 32-foot lengths.

Write today for more information on the NEW Keystone HDG Ladder Mount.

Philadelphia 32, Pa. *Represented in Canada by Lyman Tube and Bearings, Ltd., Montreal and Toronto*

BRIGHTEN DARK CORNERS AND NEAR-WALL AREAS WITH

INCANDESCENT

GUTH BRACKETS

(YOU NAME IT . . . WE MAKE IT!)

FLUORESCENT

20 WATT HALF-PEERLITE * with GrateLite** Louver-Diffuser — center reflector — up and down light
2-IN-1*—with GrateLite Louver- Diffuser — an indirect cove — or a louvered down-lite. Just turn it over!
HALF-PEERLITE*— one or two lights
DOWN-LITE-BRAC with GrateLite
ANGLED-GLASS BED LITE — 2-20W — up and down light

APPLICATIONS GALORE!

. . . in barber shops; fitting rooms; over hospital beds, chalk boards, mirrors; for desks near walls; along ceiling beams . . . and many other spots that are difficult to light efficiently with conventional fixtures.

Guth

TRUSTED
NAME IN LIGHTING
SINCE 1902

WRITE ON YOUR LETTERHEAD FOR BULLETIN 929-H TODAY.

THE EDWIN F. GUTH CO. • ST. LOUIS 3, MO.

*Trademark Registered

**Trademark Registered U. S. & Can. Pats. Pend.

Cable splices made faster, last longer in toughest "proving ground" here in The Bessemer Limestone and Cement Company's quarrying operation. Note the rough surfaces over which the cable is dragged. Under conditions that vary from extreme dryness to complete submersion, Bessemer reports exceptional results from the rugged splices made with Okonite Tapes.

Okonite Tapes reduce down-time for Bessemer shovels

The Bessemer Limestone and Cement Company has reduced down-time on its electric shovels two ways by using Okonite Tapes in splicing its high voltage portable shovel cables. First, tough, waterproof splices can be made in the field without taking the cable to the shop and without buying any special molds and other equipment. Second, splices made with Okonite Tapes have been in service since 1948 without added time-loss in remaking.

Cables and splices are dragged over rocks, frequently lie completely submerged in water, and are constantly exposed to sun, rain, snow and ice. Yet Okonite splices have maintained their waterproof toughness for seven years of this treatment. No wonder Bessemer has standardized on Okonite Tapes.

Each splice is designed to give maximum electrical and mechanical protection for operation at 4160 volts. Okolite Corona-Resisting Tape fuses into a solid wall of self-vulcanizing high voltage insulation. Over the shielding tape applied about the three-conductor core, a solid wall of Okoprene Weather-Resistant Tape gives full neoprene protection to the splice. This combination of Okolite and Okoprene Tapes provides the toughness and complete moisture resistance necessary for continued service under such severe operating conditions.

Try them on your splices—write for a free box of 4 sample tapes to The Okonite Company, EW Tape Department, Passaic, N. J.

Available Through Authorized Dealers Only.

OKONITE **splicing tapes**

3522

FEDERAL PACIFIC METAL-

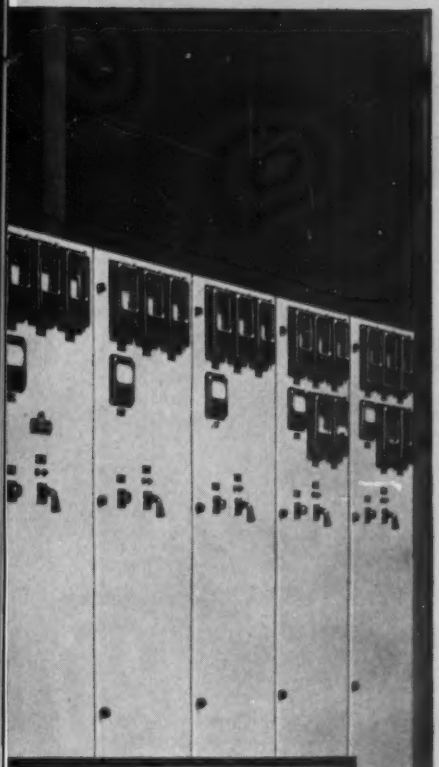
FPE
FEDERAL PACIFIC ELECTRIC

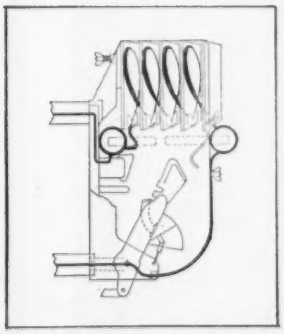
Horizontal DRAWOUT AIR Circuit Breaker—mounted on four-wheel truck can be easily moved "in" and "out" of its cell. Guide rails engage breaker wheels to insure proper contact alignment. Breakers of like rating are completely interchangeable.

Finest Products Engineered

FEDERAL PACIFIC

CLAD SWITCHGEAR





Solenarc Principle of Arc Interruption—Arc moves upwards between chamber plates and is formed into a series of rapidly expanding loops. As a result of extremely fast arc elongation and more efficient utilization of the arc chamber cooling surfaces—circuit interruption occurs at or near the first current zero.

Combines most advanced breaker design with proven advantages of Metal-Clad construction

Modern, functional in appearance, Federal Pacific Metal-Clad Switchgear design is being proved over and over again in a rapidly increasing number of trouble-free installations. Completely assembled, wired, and adjusted at the factory—Federal Pacific Switchgear is thoroughly tested before shipment.

MOST ADVANCED MAGNETIC AIR CIRCUIT BREAKER DESIGN—utilizing Solenarc principle of arc interruption for exceptionally fast, positive arc extinction. The reliability of these breakers has been field-tested in hundreds of installations and their interrupting ability proved by exhaustive laboratory tests.

FLEXIBILITY—removable breakers and associated equipment are installed in individual free-standing enclosures and bolted together to form complete switchgear assembly...permits easy field installation of additional units.

SHEET STEEL BARRIERS—divide section interiors into compartments isolating breakers, busses, instrument transformers, and cable terminations...permits complete accessibility...safeguards personnel from adjacent live circuits.

SHIPPED READY FOR INSTALLATION—overall assembly can be divided into shipping sections for convenient handling by purchaser.

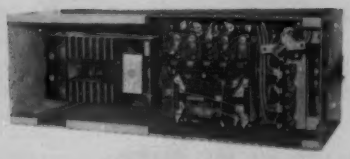
NEW Scranton Plant—specially designed to provide the latest in switchgear manufacturing facilities—this spacious new plant consolidates Federal Pacific's assembled switchgear activities in one location.

ELECTRIC COMPANY

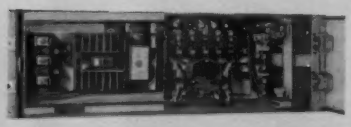
50 Paris Street, Newark 1, N. J.

FPE

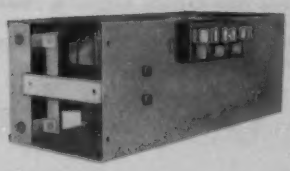
FEDERAL PACIFIC ELECTRIC



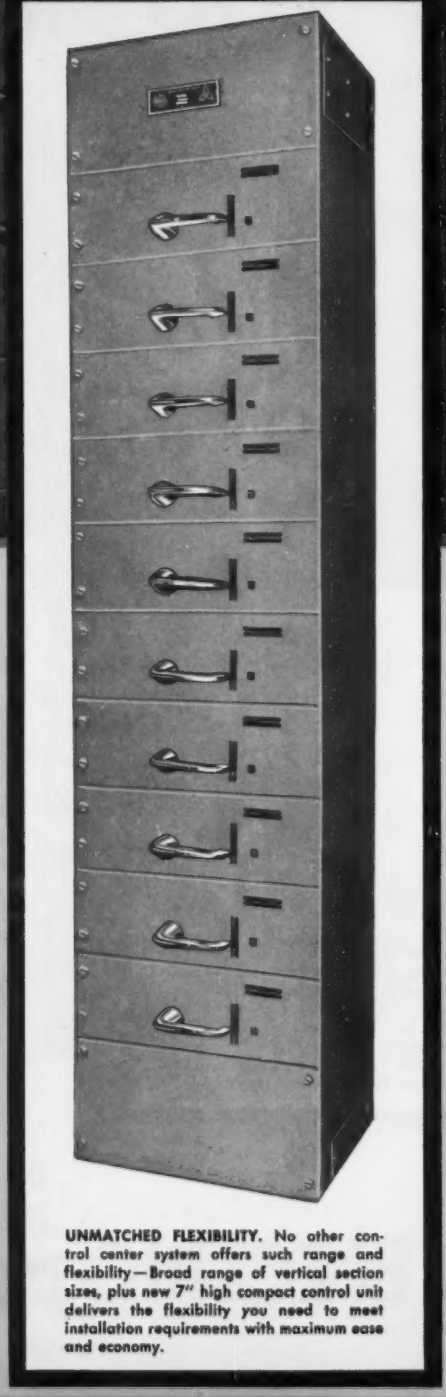
COMPACTNESS PLUS ACCESSIBILITY to circuit breakers or motor starter is secured by space-saving arrangement of components.



COMPACTNESS WITHOUT SACRIFICE TO SAFETY FEATURES or any of the necessary operational accessories such as push buttons, indicating lights and auxiliary relays.

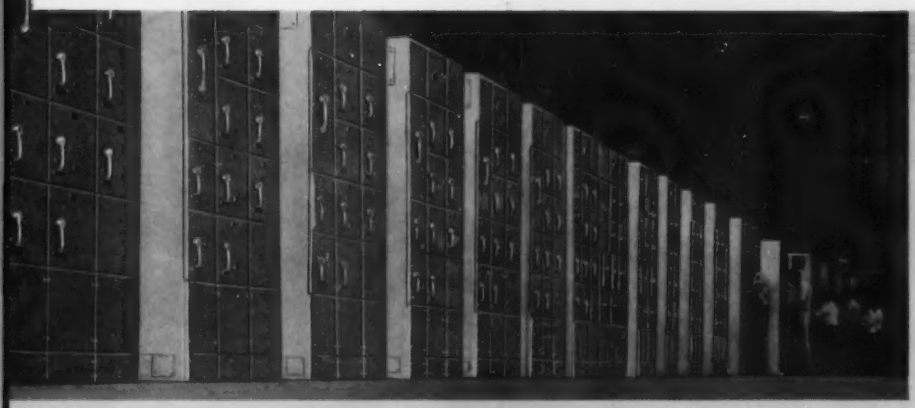


HEAVY DUTY INSULATOR of high impact, low tracking material provides interphase barrier for stabs; silver copper alloy stabs reinforced with pressure springs to assure contact with both sides of bus.



UNMATCHED FLEXIBILITY. No other control center system offers such range and flexibility—Broad range of vertical section sizes, plus new 7" high compact control unit delivers the flexibility you need to meet installation requirements with maximum ease and economy.

Now! FEDERAL PACIFIC'S COMPACT MOTOR CONTROL CENTER GOES THE INDUSTRY ONE BETTER!



ASSEMBLY-LINE PRODUCTION SPEEDS DELIVERY. Standardized designs and stocking of component parts in Federal Pacific's regional plants facilitate engineering service and faster delivery.

. . . Permits As Many As 20 NEMA Size 1 Plug-in Control Units in Standard 90" High Section!

It's new! It's Compact! It's Federal Pacific! The smallest production built combination plug-in motor starter unit in the industry today! The new Federal 7" high "Compact Unit" literally doubles the number of NEMA size #1 starters that can be used within a vertical section...permits as many as twenty in a standard 90" high back-to-back section.

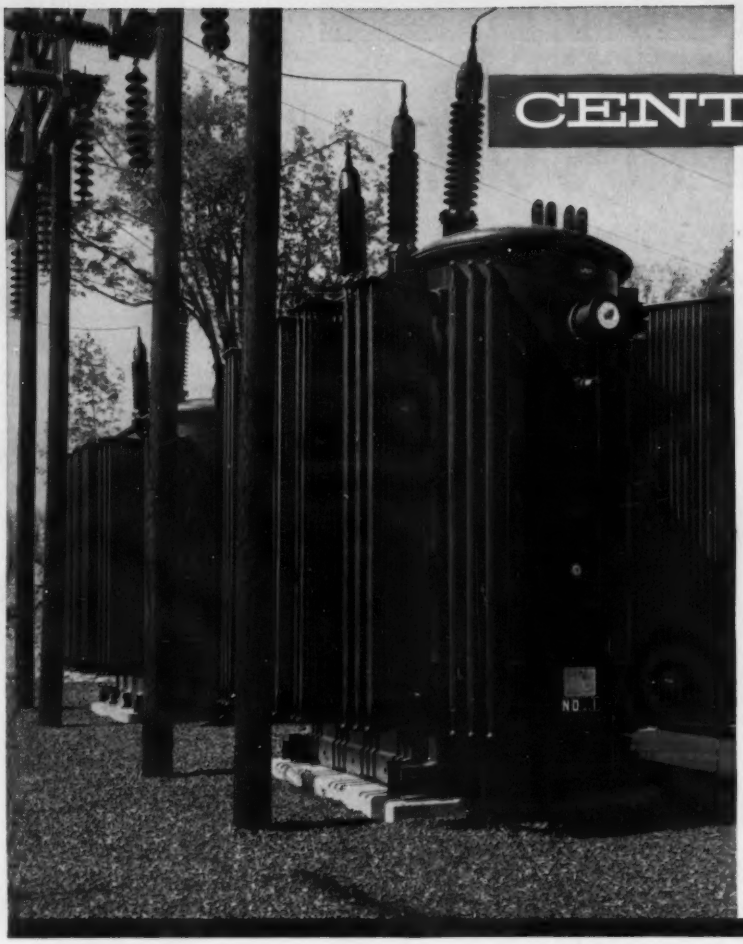
Ideal for use where a large number of small motors must be protected and controlled. These compact units are available in circuit breaker combination starters and with standard accessories such as "Start–Stop" push button, indicating lights, control circuit transformer, and auxiliary relay. Supplied in NEMA Class A, B or C wiring.

Finest Products Engineered

FEDERAL PACIFIC ELECTRIC

COMPANY

50 PARIS STREET, NEWARK 1, NEW JERSEY



CENTRAL

power transformers help speed construction of St. Lawrence power project

2 10,000 KVA, 3-phase 115 KV to 13.8 KV Central transformers now in service at Polley's Bay Substation, Massena, N. Y. Uhl, Hall & Rich, Boston, Mass., engineers for St. Lawrence Project.

Designed, manufactured and tested in Central's modern plant for the New York Power Authority, these Central transformers are furnishing power for the construction of the gigantic St. Lawrence Power Project.

No matter what your requirements may be, there's a precision-built Central transformer to fill them to your complete satisfaction. We welcome your inquiries.

a type for every need . . . from the smallest to the largest

DESIGNERS AND MANUFACTURERS OF TRANSFORMERS ONLY

CTC NEMA

Sales offices in principal cities
PINE BLUFF, ARKANSAS

Central TRANSFORMER CORP.

Progressive engineering

makes Nordberg Engines your logical choice for power generation

Nordberg, a pioneer in the Diesel and Gas engine industry in the United States, has always occupied a prominent position among the world's leading builders of internal combustion engines. Over the many years Nordberg has contributed many of the most notable advancements in the development of more efficient prime movers . . . all in the interest of improved fuel economy, simplicity of design, less maintenance and better overall performance.

Nordberg research, engineering and development continues to direct its efforts toward further achievements by intelligently anticipating power requirements. As a result of these efforts Nordberg today . . . with a full range of engine sizes from 10 to over 12,000 horsepower including Diesel, Duafuel® and Spark-Ignition Gas types . . . is in the best position to solve your specific power problems.

Write for further information.

NORDBERG MFG. CO., Milwaukee, Wisconsin

NORDBERG

DIESEL • DUAFUEL® AND SPARK IGNITION GAS ENGINES

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P156

This IS THE SERVICE ENTRANCE CABLE FOR TODAY'S HIGHER LOADS WITH TRIANGLE RH-RW INSULATION

Today's highly electrical homes demand a Service Entrance Cable with the ability to handle much heavier loads than ever before. That's why Triangle changed to a better insulation—Type RH-RW. All Triangle Service Entrance Cable is now furnished with this fine insulation. Type RH-RW insulation exceeds Underwriters' specifications for either RH or RW.

Triangle Service Entrance Cable, with Type RH-RW insulation, is far and away your best buy. Not only does Triangle Service Entrance Cable incorporate today's highest quality insulation, the cable also has these outstanding advantages:

1. "Silver" outer cover.

Clean, smooth, good-looking, takes and holds paint, easy to strip.

2. Tough and weatherproof—yet flexible.

The cover and inner construction of Triangle Service Entrance Cable are made for *long-lasting* ruggedness and flexibility. The outer braid is a unique combination of glass filaments and long-staple cotton for long life and a guarantee against peeling, cracking or festooning. Inner layers are made from the best available material—so good, that you can "feel" the quality of this cable the minute you handle it.

It Must Be Right
The Trade Mark of TOP Quality
TRIANGLE ®

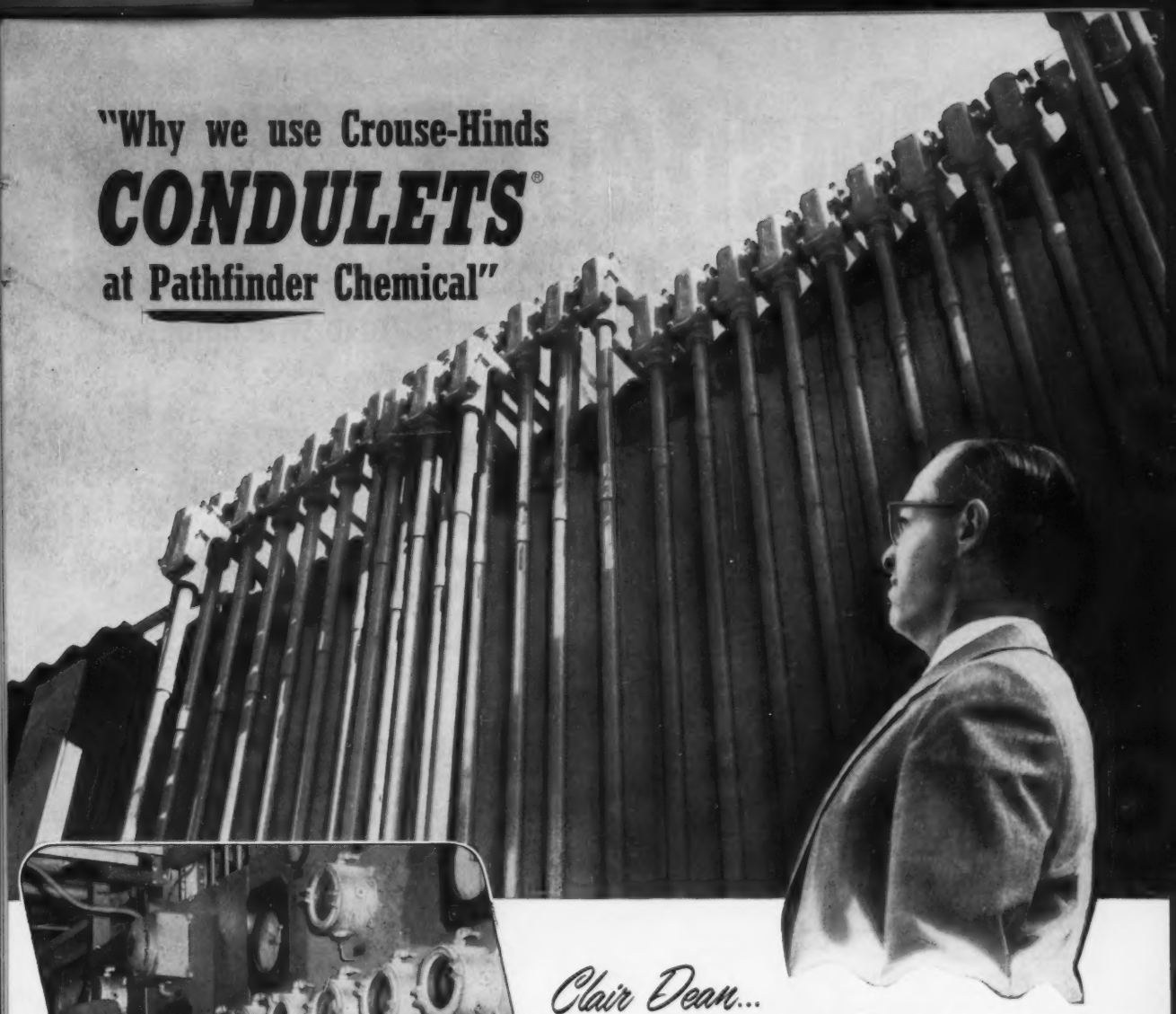
TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, N. J.

Manufacturers of Arteries for Electricity, Liquids and Gases

WIRE • CABLE • CONDUIT • PLASTIC PIPE • BRASS AND COPPER TUBE

"Why we use Crouse-Hinds CONDULETS® at Pathfinder Chemical"



Clair Dean...

Engineering Manager at Buffalo Electric Co., Electrical Contractor for Pathfinder Chemical Division, Goodyear Tire & Rubber Company explains:

"You find Condulet electrical equipment all over the Pathfinder plants – from complex explosion-proof instrument enclosures on the panelboard shown at left, to simple explosion-proof pulling elbows on the branch circuits at top. We like Condulet equipment because it installs easily, works right, and stays on the job for years without attention."

There are more than 15,000 items listed in the Condulet Catalog: conduit fittings, plugs and receptacles, motor controls, lighting fixtures, switches, hundreds of others, both explosion-proof and conventional. Make your selections with confidence. You get the best when you get Condulets.

Our distributors have the facts. Or contact a Crouse-Hinds Office below.

A NATIONWIDE **DISTRIBUTION** exclusively through **ELECTRICAL DISTRIBUTORS**

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S&C Positect

gives

1 HIGHEST INTERRUPTING CAPACITY
2 FULL LOAD SWITCHING
3 SAFETY

These are the reasons so many large utilities—after exhaustive testing—have "standardized" on the Positect.

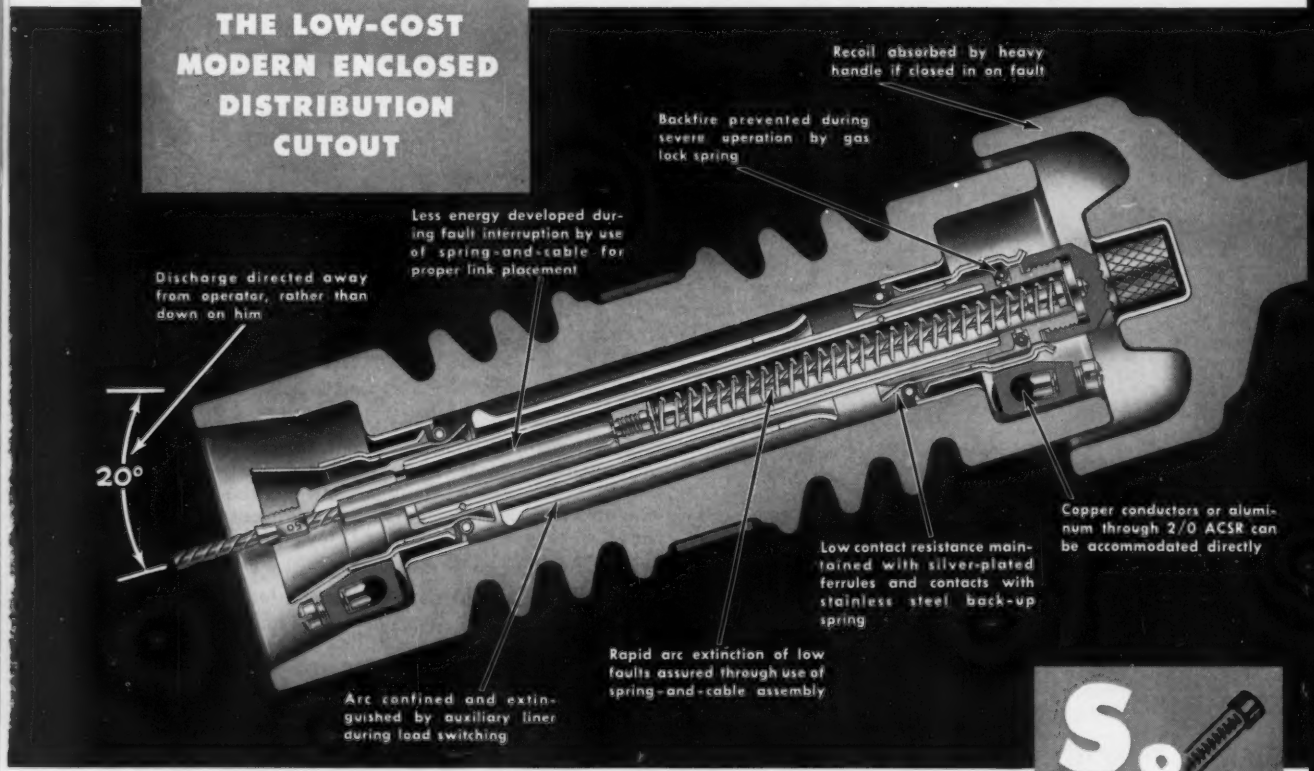
The high interrupting capacities—10,000 and 12,000 amperes assymetrical for the 50 and 100 ampere sizes, respectively—are backed up by 14,000 and 16,000 ampere one-shot ratings, matching the high faults on today's distribution feeders.

Full load switching—200 amperes of load current, and associated magnetizing and charging current—is positive and without external arcing. And—best of all—there's built-in safety for the operator. Hook stick operation is unnecessary.

For details on the many advantages of "standardizing" on the Positect, write for Catalog Sec. 520 . . . we will gladly send one.

Load switching is accomplished by removal and insertion of bayonet.

THE LOW-COST MODERN ENCLOSED DISTRIBUTION CUTOUT


Recoil absorbed by heavy handle if closed in on fault
Backfire prevented during severe operation by gas lock spring
Less energy developed during fault interruption by use of spring-and-cable for proper link placement
Discharge directed away from operator, rather than down on him
20°
Copper conductors or aluminum through 2/0 ACSR can be accommodated directly
Low contact resistance maintained with silver-plated ferrules and contacts with stainless steel back-up spring
Rapid arc extinction of low faults assured through use of spring-and-cable assembly
Arc confined and extinguished by auxiliary liner during load switching

Specialists in High-Voltage Circuit Interruption since 1910

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.
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POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

ELECTRICAL BUSINESS OUTLOOK

Electrical World

MARCH 19, 1956

Freight rate increases approved by the Interstate Commerce Commission effective March 7 allow railroads a maximum increase of 15¢ per ton on coal. Based on last years consumption **this increase alone could cost the nation's utilities about $20.7 million.** Tack on another price increase due next month when the second half of miners wage increases become effective, and you get a rough idea of the jump utility operating expenses will take this year. Before the recent increase, freight rates were already 90% of the price of coal at the mine. This point was made by an industry group of 13 utilities from Michigan to Georgia in hearings before the ICC. The group predicted that the freight rate increase could lead to the substitution of other fuels and/or location of new generating facilities near mines to avoid the high cost of shipping coal.

• • •

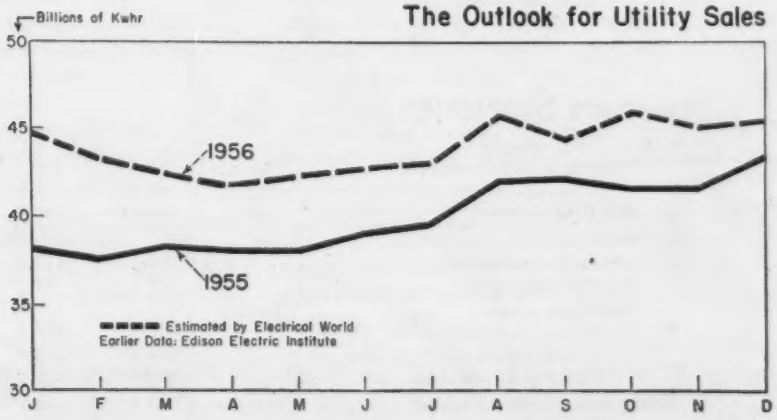
Raising copper prices did little to ease competition between European and domestic markets. The boost in copper prices in the U.S. was immediately reflected by an increase on the London Metals Market to meet the threat of diversion of supplies to American markets. Although rising world production holds promise of meeting the large increase in consumption, market observers believe Europe's insatiable appetite for the red metal makes competition with the U.S. a continuing possibility for some time to come. It appears the Chilean government shares this feeling—only recently, as copper prices hit a record high of 56½¢ per lb in London under the threat of armed conflict in the Middle East, **Chilean officials were reported seeking a further price increase in the U.S.** Phelps Dodge officials on the other hand feel that additional production in 1956 —200,000 tons from new and expanded facilities and about 155,000 tons lost by strikes in 1955—should balance world supply with demand.

• • •

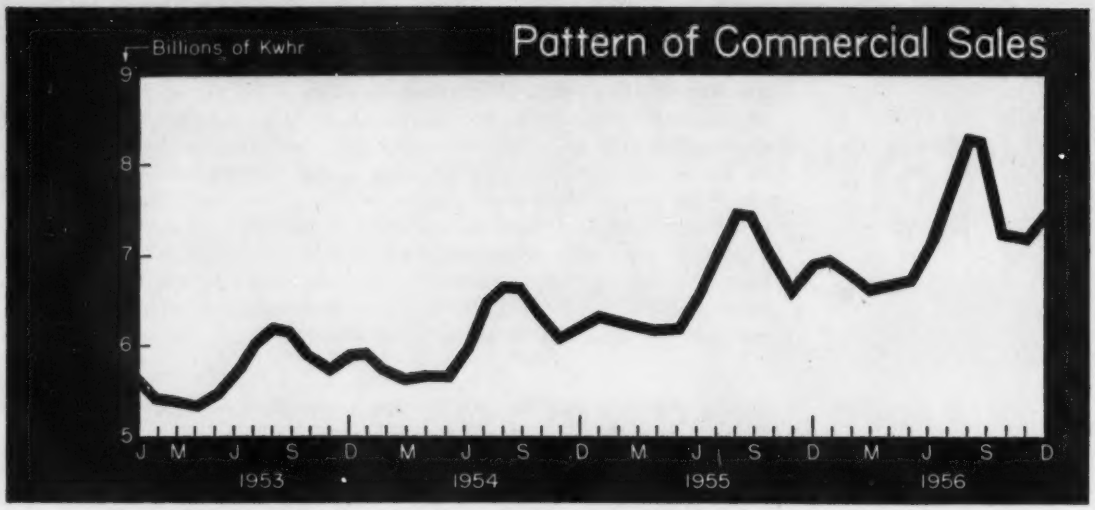
Philip Sporn of AG&E is backing up his forecast of a fourfold increase in his company's power sales in the next 20 years with a $700 million expansion program. This will add 2.6 million kw to the system between 1956-60. Although Sporn's prediction follows the industry pattern of doubling every ten years, **his immediate plans call for a capacity increase of 65% by 1960—just five years.**

• • •

Color television could mean 1.9 billion kwhr in utility power sales by 1960. This is based on a prediction by A. B. Pinkham, vice president of National Broadcasting Co, who says there will be 12 million color sets in service by 1960. Figuring 400 w per set in use for a conservative 400 hours per year (black and white averages more than 1,500 hours) you get 1.9 billion kwhr.



STATISTICS



Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change%
Capacity	Dec.	114.37	113.55	102.59	11.5
Peak—Class I Systems, million kw	Dec.	98.2	96.4	85.7	14.6
Estimated Dec. '56 Peak	Dec.	105.27	104.55	102.64	2.6
Production—billion kwhr	Dec.	50.72	47.76	43.45	16.7
Hydro		9.31	9.21	9.05	2.9
Fuel		41.41	38.54	34.38	20.4
Sales—billion kwhr	Dec.	45.19	43.07	38.06	18.7
Residential		12.25	10.71	10.89	12.5
Commercial		6.81	6.61	6.19	10.0
Industrial		23.75	23.37	18.75	26.7
Other		2.39	2.38	2.23	7.2
Fuel Consumption	Dec.				
Coal—million tons		14.77	13.29	11.91	24.0
Oil—million barrels		8.54	7.10	7.69	11.1
Gas—billion cu ft		70.00	82.26	74.85	−6.5
Net Income Class A & B Co's—$ million	Nov.	104.29	95.67	95.12	9.6
Residential Customers—millions	12 mos.	44.41	44.30	43.14	2.9
Revenue per kwhr	ended	2.64¢	2.65¢	2.69¢	−1.9
Avg kwhr per customer	Dec. 31	2,751	2,728	2,549	7.9
Avg annual bill		$72.63	$72.29	$68.57	5.9

Business Statistics . . .

Indexes: 1947-49=100					
FRB Industrial Production	Jan.	143	141	132	8.3
ENR Construction Cost	Feb.	142.6	141.8	135.3	5.4
BLS Cost-of-living	Jan.	114.6	114.7	114.3	0.3
NEMA Sales	Dec.				
Insulation materials		160	155	138	15.9
Electric appliances		101	88	74	36.5
Wholesale prices	Dec.				
Motors and generators		127.2	127.0	121.8	4.4
Transformers and regulators		129.2	129.2	128.1	0.9
Switchgear and fuses		145.9	145.9	135.3	7.8
GNP—annual rate—$ billion	4th Qtr.	397.3	392.0	367.1	8.2

Your Business

Electronic marvels continue to enter our lives. Two of the latest: A ¾-ounce, cordless hearing aid; A recording device you can conceal in a brief case.

The hearing aid is shaped like the ear and worn behind it. It is invisible from most angles on men and is completely hidden by women's hair. It includes four transistors and a battery smaller than a dime.

The recording device is capable of four hours of silent, continuous operation. Hidden away in a brief case it can pick up everything said in a room from 12 ft away.

A new stamp catalog may be of interest to certain collectors. Aimed at "topical" philatelists, it traces the development of telecommunications through stamps. The book is "Radio-Philatelia," by Herbert Rosen, issued by Audio Master Corp (17 East 45th St, New York 17, N. Y.), and costs $2. Of particular interest are those stamps featuring some of the historic figures in the development of electricity—Volta, Ampere, Tesla, Siemans, von Guericke, Edison, and others.

Travelers Credit Service, Inc, can add enjoyment to your travel if you go to Europe this summer. This organization offers credit privileges abroad and also special insurance for all its members.

Credit privileges are available for a $15 fee. This entitles you to charge meals, purchases, and car hire at a select list of restaurants, shops and clubs.

"Just where did you say the new man learned his splicing?"

The list is contained in a guide book giving detailed information about every establishment listed. TCS claims its arrangements are with only the best places in Europe.

The insurance is available to members for another $15. It provides a one-year coverage and offers $20,000 travel accident insurance, $1,000 for medical expenses, and $1,000 baggage insurance. The policy is good world-wide but excluding the U. S., its possessions, and Canada.

If you are susceptible to seasickness, the results of an armed services study might be of interest. Eleven drugs were found helpful in easing discomfort but the three top drugs are: Bonamine, Phenergan, and Marezine.

Your Health

REX H. WILSON, MD, Medical Director, B. F. Goodrich Co

Most men will have prostrate gland trouble during their lifetime. This sponge-like mass of tissue located at the mouth of the urinary bladder is frequently infected. It may become enlarged, especially in older men, to the point of obstructing the normal flow of urine. The gland is one of the common sites of cancer in the male.

Pain, burning, and frequency of urination are the usual symptoms of infection of the gland. Enlargement is indicated by increasing difficulty in urinating. Obstruction of the bladder causes a desire to urinate small amounts frequently both day and night. Low back pain may be a symptom of prostrate disease. Cancer may be present with no particular symptoms.

Early treatment of prostrate gland disease is imperative to avoid damage to the bladder and kidneys. Fortunately, most infections can be cured with proper medication. Enlargement may be controlled with massage of the gland. If the glandular enlargement is sufficient to obstruct the urinary canal, surgery is necessary.

There are several types of operations now being performed by urologists with very little danger to the patient. If cancer is present, total removal of the gland is indicated. Normal urinary and male functions can be expected after recovery from prostrate gland surgery.

Prostrate gland disease can be detected only by careful examination. Men over 50 years of age should have their prostrates examined at least once a year and more often if they have symptoms of prostrate trouble.

Much male suffering could be avoided by proper medical care of this important organ. Why settle for 50 years when you could have 100?

WASHINGTON COMMENT

Public Power Backers Seek Public A-Power

Hint that an all-out government reactor program is needed to push U. S. out in front of other countries. Preference for public bodies is important corollary

Public power efforts to put the government in the nuclear power business gained new impetus last week in Congress. This threat has the backing of major public power organizations.

For instance, they are latching on to Atomic Energy Commissioner Thomas E. Murray's position before the Joint Congressional Committee on Atomic Energy. He declared that the present program is inadequate; that this nation is losing out to others in the race to be first with competitive nuclear power. To overcome this, he urged Congress to order AEC to undertake a five-year $1-billion program of federal construction of nuclear power plants of 2 million kw by 1960. In the 1960-65 period he proposed that $5 billion be spent on 10 million kw with financing to be determined later.

Last year Sen Albert Gore, TVA-area Democrat and public power leader, introduced a bill to authorize a program similar to that which Murray proposes up to 1960. Gore's bill planned construction of at least one full-scale reactor of each of the major types even though these duplicated facilities planned by private firms. Nothing was done on that bill.

Now, however, public power forces are lining up behind such a scheme. With Murray's objections to cite, they are making some headway. They want:

- Preference rights for public power bodies.
- To avoid the established patent system.
- A firm voice in the development program.

Public power supporters regard the atom as a natural resource. They argue its development should be in the hands of the people through their government.

Congress has believed that the atom is an unlimited resource, capable of development by innumerable experimenters. In passing the 1954 Atomic Energy Act, Congress invited industry into the development program, purposely ending a ten-year government monopoly in the hope that industry's vast resources of brains and money could speed the day when the public will benefit.

The action of Congress—this year—in choosing between these premises will decide the outcome of the public power forces' campaign.

Murray's comment came only a few days before outstanding leaders in the private nuclear program stated their concern over the risk involved in pushing their projects forward without an adequate amount of disaster insurance (EW, March 12, p 10).

The Gore group seized on this, hinted that an all-out government reactor program is needed to push the U.S. program out in front.

Thus the campaign injecting the atom into the traditional public vs private power fight is gaining momentum. If it is to be checked, something must be done, perhaps a price paid. Putting the government in the atomic insurance business may be the price many industry people are most willing to pay.

But unless private industry insists that it be allowed to do the job and does it, the nation may see renewed activity for a TVA-scale federal atomic power program reminiscent of New Deal days.

TECHNICAL NOTES

Cutting the impedance of constant-current transformers enables them to carry mercury street lighting closer to their rated capability.

Untreated pin insulators, long condemned for RI, seem to cause little TVI.

Exhaust hood of a turbine will overheat because of excessive windage loss in the low-pressure section in case the unit motors on the line with steam shut off. A temperature alarm is relied upon for protection.

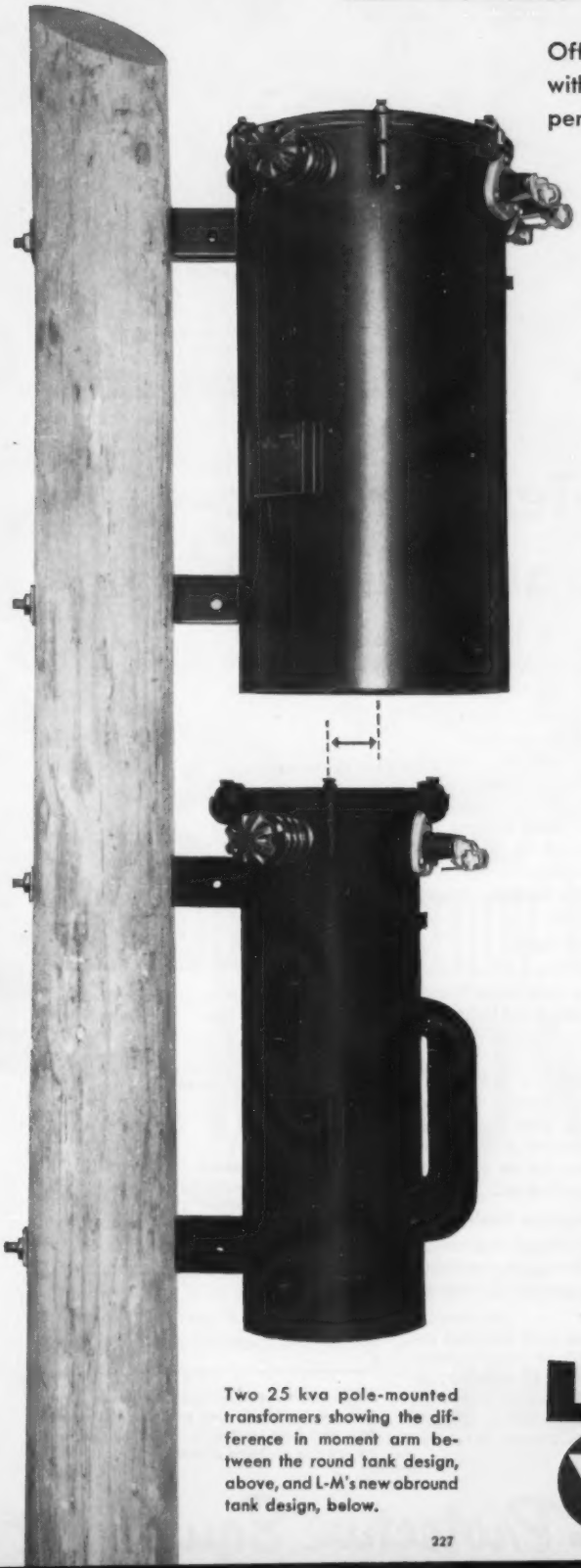
Age slows the attack of unlined concrete ducts on lead cable sheaths.

A series capacitor applied to improve voltage for a specific customer operating a large motor may create flicker trouble from excessive voltage rise for other customers closer to the source.

Film cut outs across mercury street lamps supplied from a series circuit through insulating transformers permit reducing their leakage reactance. This, in turn, provides higher voltage to operate the cut-outs, better pf for the installation, and permits more lamps per constant-current transformer.

Transmission patrol by airplane is difficult for wood pole lines where short span lengths give too brief a glimpse for adequate inspection.

How L-M's New Obround Design Provides 27% Less Bending Moment



Two 25 kva pole-mounted transformers showing the difference in moment arm between the round tank design, above, and L-M's new obround tank design, below.

Offers 33⅓% increase in transformer capacity on a pole, with no sacrifice of L-M's outstanding Round-Wound® performance characteristics.

L-M's new obround tank design is smaller, lighter, and has a shorter moment arm on the pole. The total bending moment is substantially reduced. Thus the potential capacity of all your transformer structures is greatly increased. L-M's new obround tank design retains all the outstanding Round-Wound performance characteristics.

Less Weight, Shorter Moment Arm

The new obround design has a smaller tank with less transformer oil, resulting in a lighter, easier-to-handle transformer. Cooling tubes are installed where required to provide adequate cooling surface. Transfer of heat from copper to outside air is faster and more efficient because of reduced mass.

The new obround design also reduces the moment arm distance from the pole. The combination of less weight and shorter moment arm distance greatly reduces the total bending moment on the pole.

COMPARE 50 kva *round* tank design and L-M's new 50 kva *obround* tank design:

50 kva ROUND tank design:
Moment arm from center of pole.....1.6 ft.
Weight.....860 lbs.
Bending moment 860 x 1.6.....**1,376 ft.-lbs.**

50 kva L-M OBROUND tank design:
Moment arm from center of pole.....1.33 ft.
Weight.....760 lbs.
Bending moment 760 x 1.33.....**1,010 ft.-lbs.**

L-M's new 50 kva *obround* transformer puts *27%* less bending moment on the pole than the 50 kva *round* tank design. That means that you put less strain on your structures—or you can now hang three 50 kva's where you formerly hung three 37½'s—a 33⅓% increase in capacity.

Round-Wound Performance

The advantages of less weight and shorter moment arm were accomplished without changing L-M's outstanding Round-Wound performance characteristics. These characteristics include low exciting current, high impulse strength, high short-circuit strength, and high short-time overload capacity.

Get Details on L-M's Obround Transformer

Ask the L-M Field Engineer for application information, weights and dimensions on L-M obround transformers and the exclusive Round-Wound design. Or write A. B. Coyle, Product Manager, Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

LINE MATERIAL
LM® Transformers

Overload indicator is quickly and easily reset by simply pushing indicating light socket up.

The L-M Transformer Overload Indicator is easily installed on transformers in service. It is secured to the transformer tank wall by a stainless-steel zigzag wire wrapped around the tank.

Maintain High Service Continuity With

L-M's New Ambient-Temperature-Compensated Overload Indicator

Accurate, economical, easy to install on transformers in service; measures tank wall temperature; provides continuous overload check without interrupting service.

W. H. ENGLAND
Application Engineer
Protective Equipment Division
Line Material Company

Line Material engineers have recognized the need for an accurate yet economical overload indicator to eliminate the costly and laborious task now required for load checking. In addition, conventional type transformers with overload indicators will eliminate the costly expense of resetting the secondary breaker on protected transformers.

We have therefore developed an indicator that assures positive overload indication, amply meets thermal, mechanical, and economical requirements, and does not interrupt service to customers.

The overload indicator is a tool which you can utilize extensively to obtain and maintain a high continuity of service. It will enable you to keep your hand on the pulse of your distribution load.

Compensates for Ambient Temperature

The device indicates thermal overloads accurately. It measures tank wall temperature (a function of top oil and hot-spot temperatures), and makes proper allowance in transformer loading for variations in ambient temperature.

The indicator is easily installed on transformers in service. It is secured to the transformer tank wall by a stainless-steel zigzag wire wrapped around the tank. On new L-M Round-Wound® transformers from the factory, the indicator is attached to a strap permanently welded to the transformer tank.

Illuminated Target

When the indicator reflects a transformer overload condition, a tube target drops, exposing and energizing a red light. The light is readily discernible in daylight as well as at night.

The indicator target is also available wrapped with reflecting tape, which is exceptionally brilliant and easily distinguished. This indicator without the red light does not require an electrical connection to the transformer.

Low Cost; Pays for Itself

The cost is low. The indicator will quickly pay for itself through reduction in transformer burnouts and elimination of load checks.

Get information on the L-M overload indicator today. Ask the L-M Field Engineer for bulletins and complete information; or write Line Material Company, Protective Equipment Division, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

Illuminated target affords positive overload indication which is easily seen during the day or night.

L-M Transformer Overload Indicator in normal and overload indicating positions. The metallic tank wall heat receiver is semi V-shaped to fit on any size or shape of tank.

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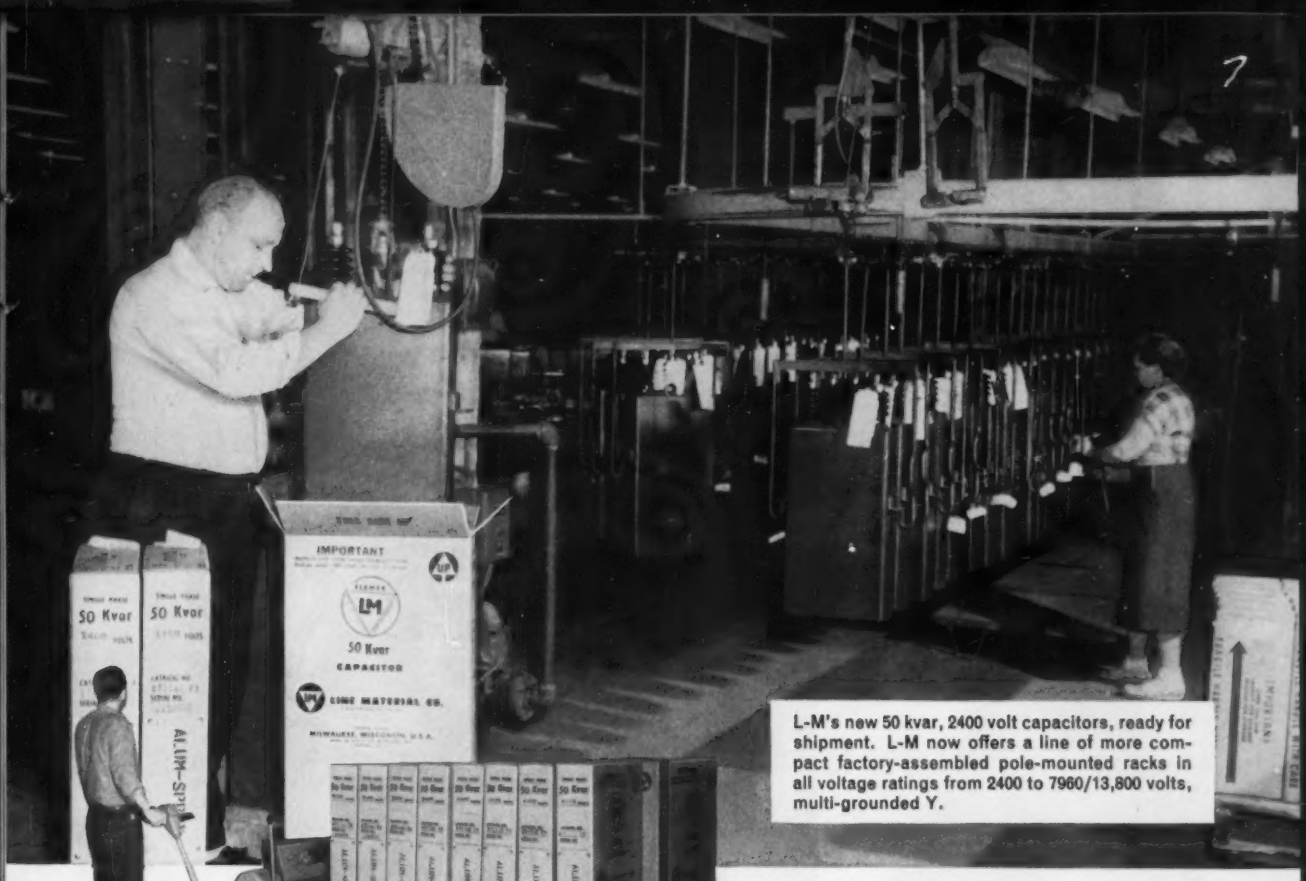
LINE MATERIAL *Protective Equipment*



L-M's new 50 kvar, 2400 volt capacitors, ready for shipment. L-M now offers a line of more compact factory-assembled pole-mounted racks in all voltage ratings from 2400 to 7960/13,800 volts, multi-grounded Y.

OFF THE PRODUCTION LINE...

You, too, can enjoy the benefits of L-M's **New 50 kvar** Capacitors NOW

Shipments have started on Line Material's new 50 kvar Elemex Capacitor. The unit is an outstanding achievement in capacitor engineering and production. It has the same width, same thickness as a 25 kvar capacitor. Only ten inches of additional height give you twice the capacity.

Per kvar, L-M's new 50 kvar capacitor is lighter, requires less pole space, and takes less installation time. Thus, installed cost per kvar is lower. It meets applicable NEMA standards for 25 kvar capacitors.

Ask the L-M Field Engineer for information on features, design and delivery of the new 50 kvar capacitor and capacitor equipments. Or write Line Material Co., Milwaukee 1, Wis. (a McGraw Electric Company Division).

LINE MATERIAL

Elemex® Capacitors

Leads of 48-inch 600-volt #12 wire furnished as standard equipment.

Bushing-Mounted Indicating Fuse with 48-inch lead can be supplied.

Solder-Sealed Bushings of strong one-piece wet-process porcelain provide a positive, lasting seal.

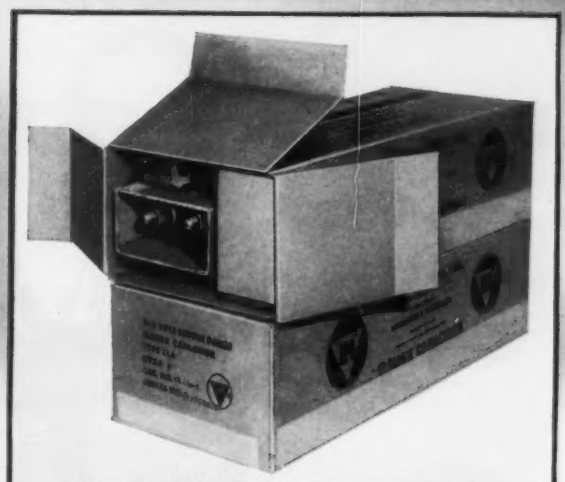
Pole-Mounting Bracket has two 9/16" holes for ½" lag screws. Standard EEI-NEMA crossarm-mounting bracket furnished if required. Capacitor can be mounted with bushings up or down.

Aluminum Metallizing process protects steel tank from oxidation; is followed by a chromate primer and a finish coat of alkyd resin paint.

Single-Pack, Round-Tank Design makes these capacitors small, light, easy to install. Unit has a one-minute discharge resistor; is completely impregnated under vacuum with low temperature Elemex liquid dielectric.

LM® LINE MATERIAL

L-M's 7½ kvar capacitor is 23½" high and weighs only 33 lbs. The 5 kvar is 18⅜" high, weighs 25 lbs. The 3 kvar is 13¾" high, weighs 18 lbs. Weights include pole-mounting brackets. Standard EEI-NEMA crossarm-mounting bracket furnished if desired.



L-M's unique shipping carton permits inspecting and testing capacitors without removing them from the carton, simply by opening the end flap—which can be resealed.

Small, Light, Easy to Install . . .

L-M's New Secondary Capacitors Provide Needed Vars For Air-Conditioning Loads

Solder-sealed bushings, aluminum metallized finish on tank, and single-pack construction assure long life, low maintenance.

By **BLAINE SCHULTZ**
Chief Engineer
Capacitors
Line Material Company

L-M's new secondary capacitor is your solution to the problem of poor voltage regulation and overloaded transformers caused by low-power-factor air-conditioning loads.

The unit is small, light, and rugged; easy to install on crossarm or direct pole mounting. It offers you outstanding design features, such as aluminum metallized tanks, solder-sealed bushings, one-minute discharge resistor, single-pack round-tank construction, and low-temperature Elemex liquid dielectric.

Protective Coating

L-M's unique aluminum metallizing process prevents oxidation of the steel tank and greatly extends the life of the capacitor. This process is followed by a chromate primer and a finish coat of alkyd resin paint. The finish coat is dark in color to facilitate heat radiation and keep the capacitor at low operating temperatures.

Solder-Sealed Bushings

Strong solder-sealed bushings of one-piece wet-process porcelain provide a positive, lasting seal. By eliminating gaskets and clamps we eliminate leakage. Therefore the capacitor can be mounted with bushings up or down.

Pack Construction

The packs are assembled in air-conditioned rooms to assure uniformity and are tested with over-voltage to eliminate any actual or potential defects. The units have a one-minute discharge resistor to assure safe handling and storage.

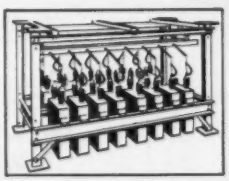
L-M's new 240-volt, pole-mounted, secondary capacitors are available in 3, 5 and 7½ kvar. 48-inch leads are furnished and external bushing-mounted indicating fuses can be supplied when required.

Ask us for complete information

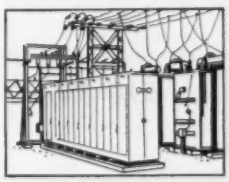
Ask the L-M Field Engineer for complete information on construction and application of L-M's secondary pole-mounted and submersible capacitor equipments, 2400- to 13,800-volt 15, 25, and 50 kvar capacitors, and our capacitor bank engineering service. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

Other L-M Capacitor Equipments

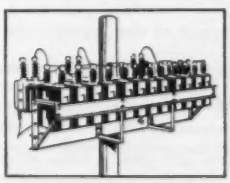
L-M offers a complete line of power capacitor equipments, such as these:



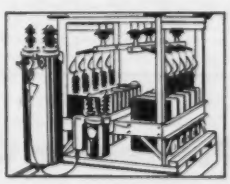
Factory-assembled blocks, which save time and money in building large banks.



Metal-enclosed capacitor equipments in all NEMA-standard sizes and ratings.



Factory-assembled racks for pole-mounted banks, both three-row and single-row styles.

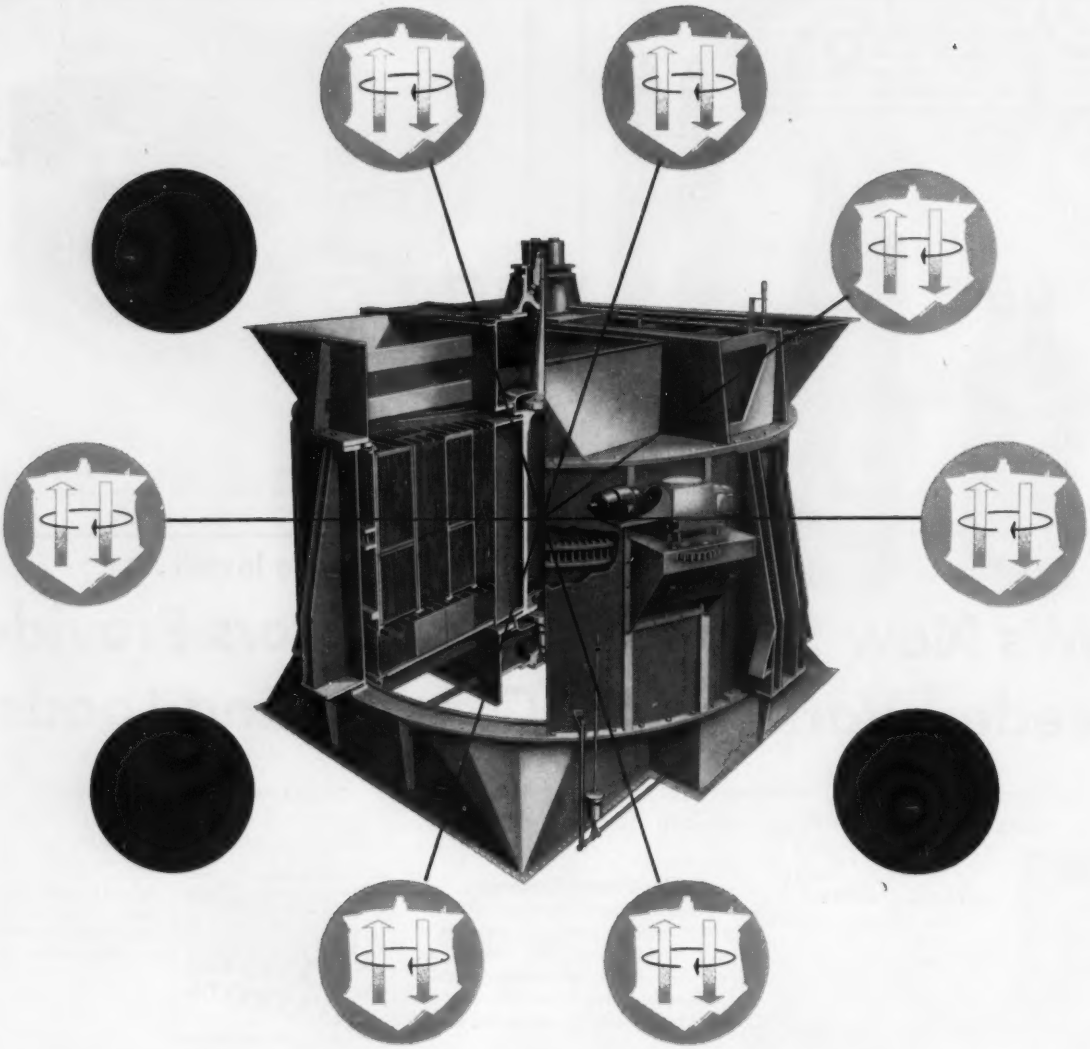


VDS-Method factory-assembled block for multi-step bank switching—an exclusive L-M method that offers a substantial saving on switching equipment.

Also custom-designed protective and switching schemes.

Elemex® Capacitors

235-R



7 out of 10 air preheater installations are Ljungstrom®

Advantages of the Ljungstrom Air Preheater

- Size for size, recovers more heat than any other type.
- Reduces fuel consumption. Permits use of lower-grade fuels. Increases boiler output and reliability.
- Eliminates cold spots . . . keeps corrosion to a minimum.
- Easier, faster to clean and maintain.
- Requires far less supporting steel and is quickly erected.

FUEL ECONOMY is the big reason. Size for size, the Ljungstrom recovers more heat than any other type of air preheater. And with every 45-50 F of air preheat you cut your fuel bill 1%.

Write now for your copy of our 38-page manual, for handy reference.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

announcing.....NEW...ALL NEW

TRANSISTORIZED

Handie-Talkie®

PORTABLE RADIOPHONES

UNPRECEDENTED PORTABLE PERFORMANCE THROUGH TRANSISTORIZED CIRCUITRY

HIGHEST RF POWER . . . New **HANDIE-TALKIE** radiophones are the *most powerful* portables ever built—up to 20 times greater power output gives you greatly extended coverage and clearer messages.

LOWEST OPERATING COST . . . Battery life and reliability is significantly improved. Dry battery replacement costs reduced by as much as 67%. Nickle-Cadmium storage batteries are lifetime rechargeable. Every component conservatively operated for longest life—top-notch performance Transmitter "I.D.C." Instantaneous Deviation Control and receiver "**PERMAKAY**" filter plus modular construction make these new portables obsolescence-free.

MAXIMUM PORTABILITY . . . Featuring transistors, exclusive PLA-cir plated chassis and all-aluminum housings, the **HANDIE-TALKIE** radiophone is smaller and lighter than ever—as much as 50% reduction in weight and size.

OPTIMUM SERVICEABILITY . . . New "swing-out" chassis design exposes all parts in *seconds* for fast, simplified servicing or alignment. "Snap-on" interchangeable power packs speed routine maintenance, permit rapid battery renewal.

Motorola, Handie-Talkie, PLA-cir, and Permakay are all registered trademarks of Motorola, Inc.

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EW

MOTOROLA

Communications & Electronics, Inc.
A Subsidiary of Motorola, Inc.
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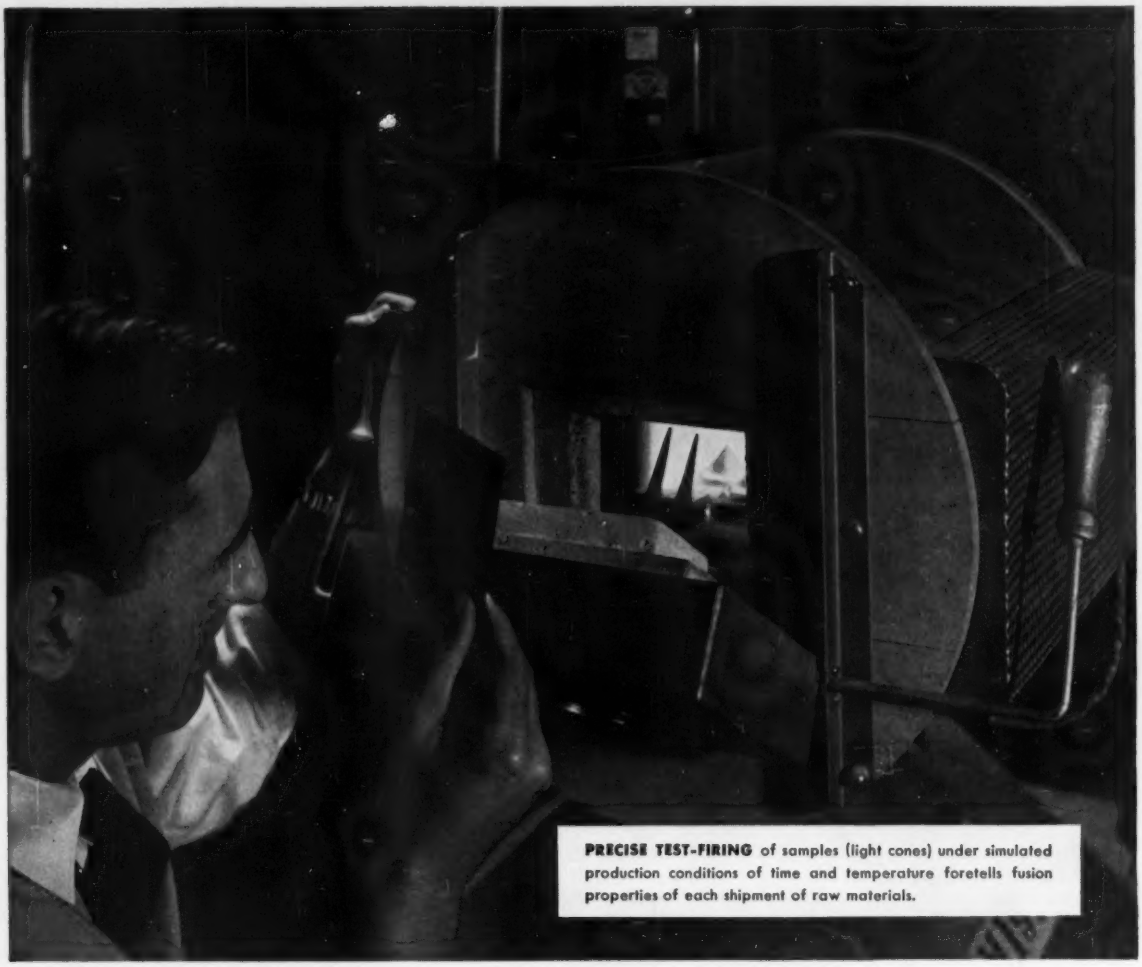


PRECISE TEST-FIRING of samples (light cones) under simulated production conditions of time and temperature foretells fusion properties of each shipment of raw materials.

How good can an insulator be? CONSIDER THE EFFECT OF RAW

The *quality* of raw materials used in the manufacture of porcelain suspension insulators has a direct bearing on insulator performance.

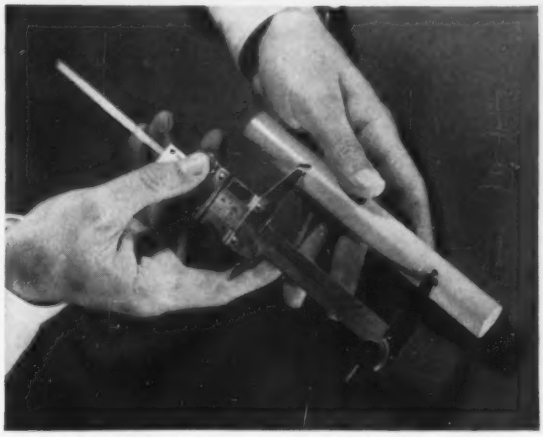
Only a slight variation from standards in the chemical composition of clay, in the vitrifying characteristics of feldspar, or in the purity of flint can result in loss of insulator strength.

To protect you against the possibility of insulators made of inferior raw materials, Locke subjects flint, feldspar and clay to 14 different quality control tests... *before shipments even enter our plant.* This prevents trouble before it starts!

The case of Locke Raw Material "Quality Control" is typical of the extremes to which Locke goes to assure trouble-free insulator service on your system.

DROP BY DROP, an analyst determines the exact proportions of silica and oxides of aluminum, sodium, potassium as well as other elements in clays and feldspar. Results are used as a production guide to assure uniformity.

FINENESS OF FLINT and feldspars is accurately determined by a screen test and compared with standards before a shipment is accepted. This physical property has direct effects on firing characteristics of these materials.



AS CLAY SHRINKS by about one eighth between forming and firing, shrinkage properties must be known in advance, so that insulator size can be accurately maintained. Test bars are extruded, notched and measured before and after drying, as well as after firing.

CLAY SAMPLE, mixed by two augers in a temperature-controlled hopper predicts how material will behave in the plastic state. The applied torque required to deform the clay sample is indicated on a chart.

MATERIALS!

For a brief and complete picture story of suspension insulator quality control, just call your Locke representative.

LOCKE

LOCKE DEPARTMENT
GENERAL ELECTRIC COMPANY
BALTIMORE, MARYLAND

LOCKE Suspension Insulators

Performance Protected by

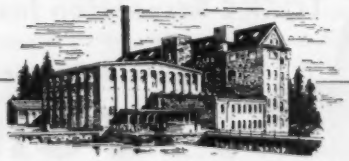
77 POINT
QUALITY CONTROL

MICAH the indispensable

... he symbolizes MACALLEN MICA

. . . top choice of electrical and industrial engineers, who rely upon MICA, the indispensable, natural insulating material — yet must have it precision-shaped and molded for uniform size and thickness . . . for dependable, economical dielectric applications. They think of it as the Mica with the PLUS!

THE MACALLEN COMPANY



BAY ROAD, NEWMARKET, NEW HAMPSHIRE

when you think of MICA . . . think of MACALLEN

MACALLEN MICA

ALL FORMS • ALL QUANTITIES • ALL DEPENDABLE

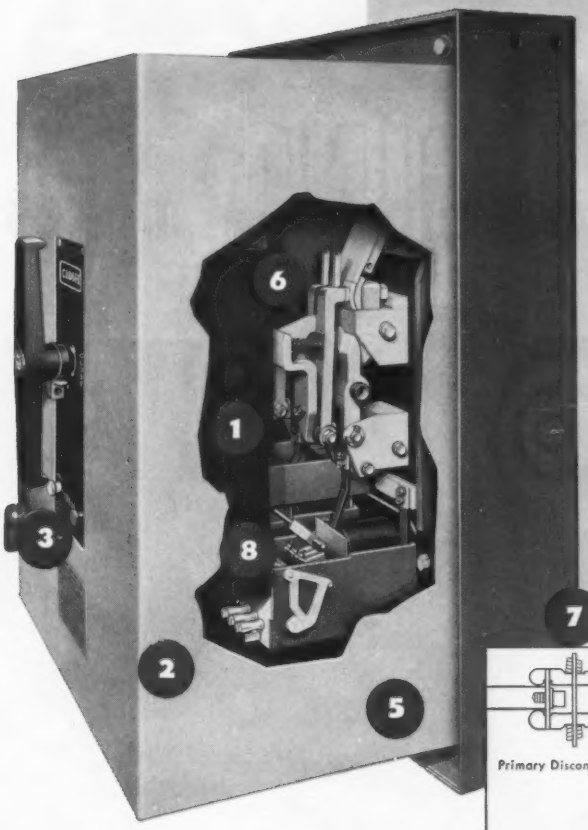
CHICAGO: 565 W. WASHINGTON BOULEVARD • CLEVELAND: 1231 SUPERIOR AVENUE

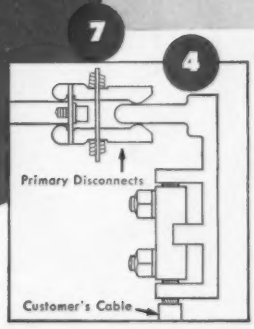
ALLIS-CHALMERS

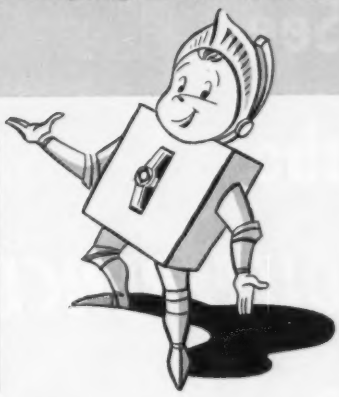
Individually Enclosed

Low Voltage Breakers

For service to 600 volts ac, 1600 amp continuous; 50,000 RMS amperes interrupting at 600 volts ac.







1. Dead front—Even with enclosure cover removed, breaker is entirely safe.

2. Accessible — Deep, removable front cover permits easy inspection and maintenance from both sides and front.

3. More safety — Interlock prevents removal of cover while breaker is in closed position.

4. Pull-out construction—Easy removal of breaker without disconnection of cables. Access to cable connections through entire front opening.

5. Weather-proof or dust-tight as well as standard, general purpose enclosures are available.

6. Long life contacts — Blow-on type action means high contact pressure — no bounce — less erosion.

7. Positive high pressure connection provided by compression springs on primary disconnects.

8. Accurate time-delay control provided by hermetically sealed, positive displacement trip device.

Get More Information — Contact your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin, for Bulletins 18B8252 and 18B8283.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-4932

DROP FORGING makes

Specify BTC Drop-Forged Hi-Line Hardware

BTC

conductor strain clamps *better*

BTC STRAIN CLAMPS offer a dependable, efficient method of dead-ending conductors on strain and angle construction.

They are designed for all conductors in general use . . . for all classes of construction . . . for all voltages . . . for all line current loads . . . and for all conditions of atmospheric corrosion.

5000 SERIES
Steel Strain Clamps. Drop-forged steel, hot-dip galvanized, suitable for all conductors.

5200 SERIES M.P.L.
(Minimum Power Loss) Aluminum Strain Clamps. Drop-forged, heat-treated Aluminum Alloy Clamps for A.C.S.R. and All-Aluminum Conductors. BTC Minimum Power Loss Clamps reduce hysterisis and eddy current power losses, eliminate conductor heating effects and improve corrosion resistance.

The general design of BTC Conductor Strain Clamps combines the superior mechanical properties and lighter weight of forged metal parts with a considerable reduction of the factors that cause conductor-vibration damage. Slip strengths are more than adequate.

Installation of these clamps is both easy and economical. No special tools are required. The conductor may be strung between clamps or from clamp to apparatus without cutting or splicing, insuring permanently trouble-free operations.

BTC offers you a complete line of Conductor Strain Clamps, in a wide range of sizes, enabling you to select just the right clamp for your conductor.

BTC

The BREWER-TITCHENER CORPORATION
Cortland, N. Y.

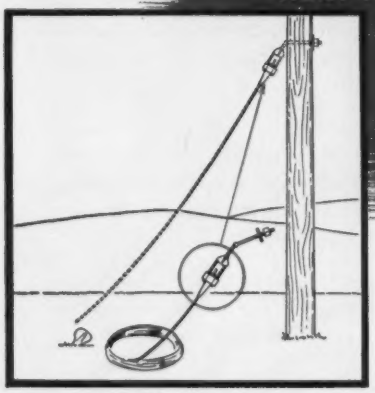
. . . From Your Insulator Manufacturer

Complete a down-guy IN 5 MINUTES?

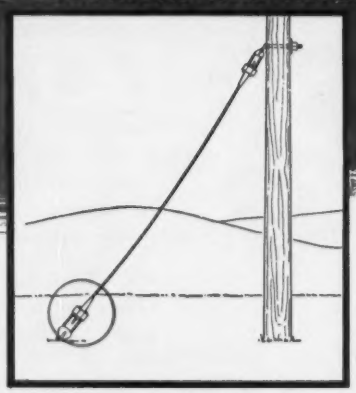
We'll bet your man can do it with . . . STRANDVISE®

Don't take that bet until you've had some of your men try this sure, simple, easy way to install down-guys — we'll even bet that you'll be boasting that some of them can do it in less than five minutes.

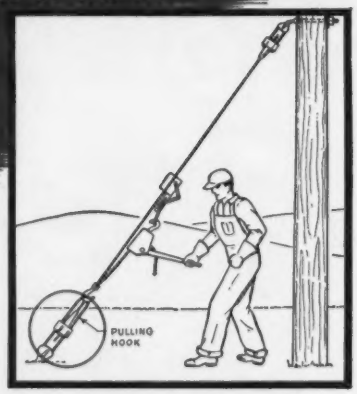
FOLLOW THESE THREE EASY STEPS:
HOIST AND COME-ALONG NEED NEVER BE IN THE WAY



STEP 1 Assemble STRANDVISE to pole-top hardware and complete pole-top installation. Do not cut strand from coil; it is usually wasteful.



STEP 2 Assemble STRANDVISE to anchor eye. Measure strand hand-tight to lower end of STRANDVISE, then cut. Insert strand and feed through STRANDVISE, just hand-tight.



STEP 3 Now place come-along and hoist and apply tension. It's just as easy for double or triple guys as it is for singles.

NOW STEP BACK, THE JOB IS DONE . . .
IT'S JUST THAT SIMPLE

And here's a new pulling hook that makes the job even easier, although a pulling hook isn't needed if anchor rod will take a come-along.

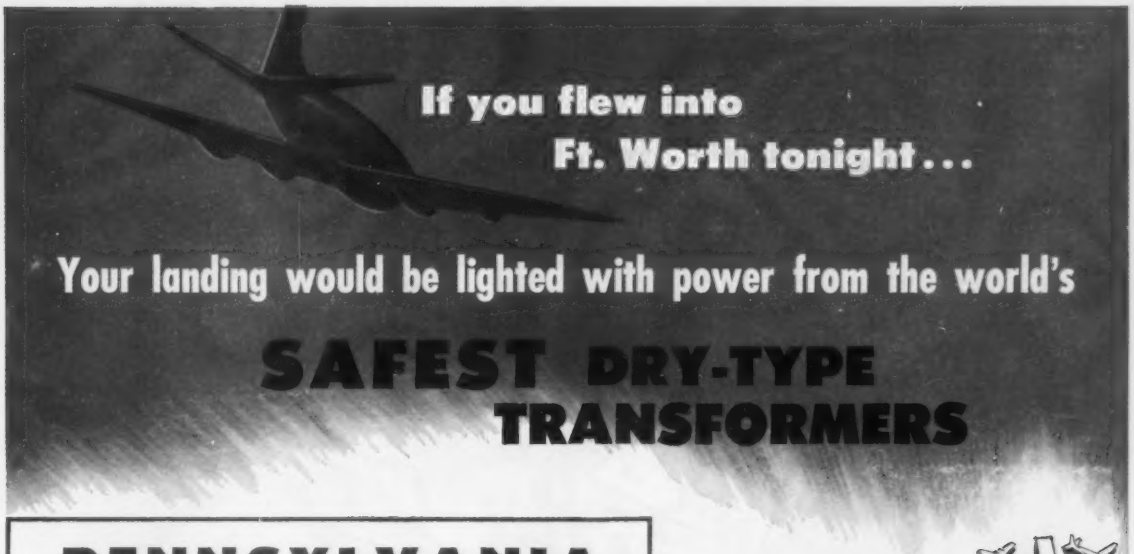
Have some of your men try the Reliable STRANDVISE for easy five minute down-guy installations . . . we'll gladly supply samples for the test.

STRANDVISE — available for 3/16" through 7/16" strand, all grades. Stainless steel (rigid) and galvanized steel (flexible) bails for all types of guy attachments.

Reliable POWER LINE CONNECTORS AND CONSTRUCTION SPECIALTIES

ELECTRIC COMPANY 3145 CARROLL AVENUE CHICAGO 12, ILLINOIS

OVER 45 YEARS OF SERVICE TO THE UTILITIES

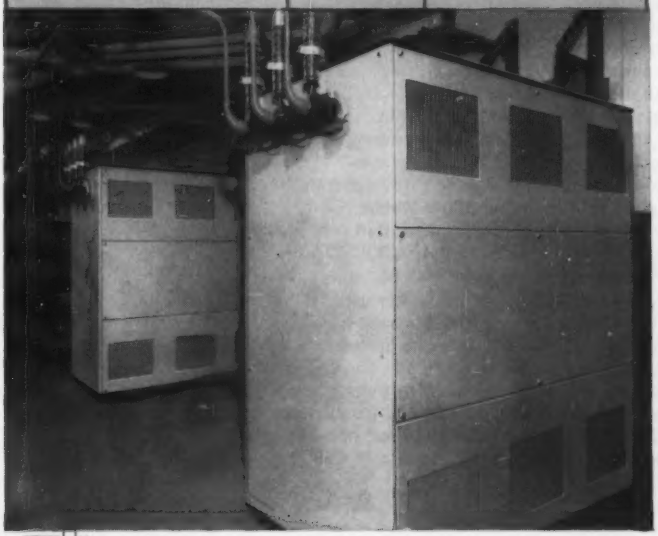


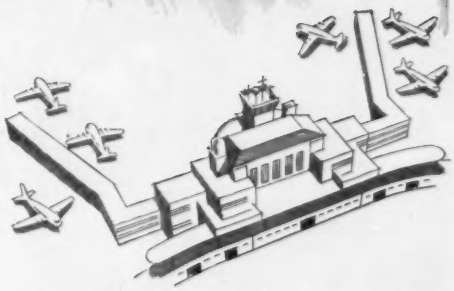
PENNSYLVANIA
Silicone-Insulated
TRANSFORMERS

at Greater Ft. Worth International Airport

are 1000-kva ventilated units, three phase, 60 cycles, 150 C. rise, 12470Y — 480Δ volts. Silicone-Insulated Transformers (formerly known as "Class H", now NEMA Group 3) were pioneered by Pennsylvania. The following types and sizes now are available:

TYPE	KVA	VOLTAGE
Ventilated	Up to 3000	Up to 15 kv
Sealed-in Nitrogen	Up to 2000	Up to 15 kv



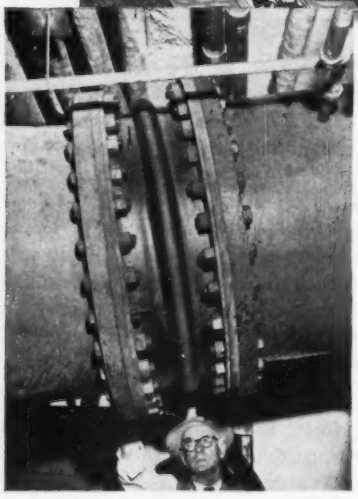


Power from two of the world's safest transformers — Pennsylvania *Silicone-Insulated* 150 C. Rise Transformers — would continue to light your way even after you stepped from the plane and entered the terminal building at Greater Ft. Worth International Airport. These two 1000-kva dry-type units are ideally suited for indoor installation because there is *no fire or explosion hazard* as with oil-filled transformers . . . *no risk from toxic fumes as* with Askarel units.

Also important, from the standpoint of public safety, is silicone insulation's *outstanding resistance to moisture* and other potential contaminants — one of the principal reasons for the trouble-free operating records of scores of Pennsylvania Silicone-Insulated units in service throughout the country. Such dependability — plus an *exceptional overload capacity* that can be called on in case of emergency — is of vital importance for the field and terminal lighting system at busy Ft. Worth International Airport.

PENNSYLVANIA TRANSFORMER COMPANY
A McGraw Electric Company Division **CANONSBURG, PA.** *Greater Pittsburgh District*

KEEPING A CITY'S FEET DRY...



Note great size of this U. S. Expansion Joint installed on a generator in the New Orleans S&WB plant at Eagle and Spruce Streets

for over 26 years U. S. Rubber Expansion Joints have been doing just that!

New Orleans is a city nestled in a saucer. Surrounded on all sides by water, many of its areas are below sea level. Add to this, one of the heaviest rainfalls in the country (as much as 15 inches in 17 hours) and you can see that this glamour city could easily be flooded.

But the New Orleans S&WB* keeps the city's feet dry by means of a pumping system that carries off the rain. Turbo-generators supply the power not only to operate this drainage pumping system but also the separate sewage pumping and the water supply systems.

26 years ago, one of these turbo-generators *(in use 98% of the time)* was equipped with 5 United States Rubber Company Expansion Joints. Why? To allow for contraction and expansion in pipe lines, and to counteract vibration. Says the Chief engineer of the S&WB: *"The U. S. Joints have never failed in all that time.* If any of them ever had, the turbine would be out of use."

U. S. Expansion Joints are widely used in the pipe lines of utility generating plants, municipal water supply systems, office and apartment buildings, ships —wherever pipe lines have to be protected against vibration, contraction and expansion. These joints soon pay for themselves by eliminating expensive maintenance and replacement in pipe lines. They eliminate noise. Once installed, you can count on years of trouble-free service. Obtainable at any of the 27 "U. S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.

US RUBBER

Mechanical Goods Division

United States Rubber

Tomorrow's fully supercharged Generator

New cooling principle fills important need as generating units grow larger

● This new design makes larger ratings practical in tomorrow's power stations.

Reports on test generator — the first with both rotor and stator cooled by supercharging — show low temperature operation and exceptional electrical characteristics, including high reactances.

This supercharged generator design has now proved its advantages in size and performance over any previously built units.

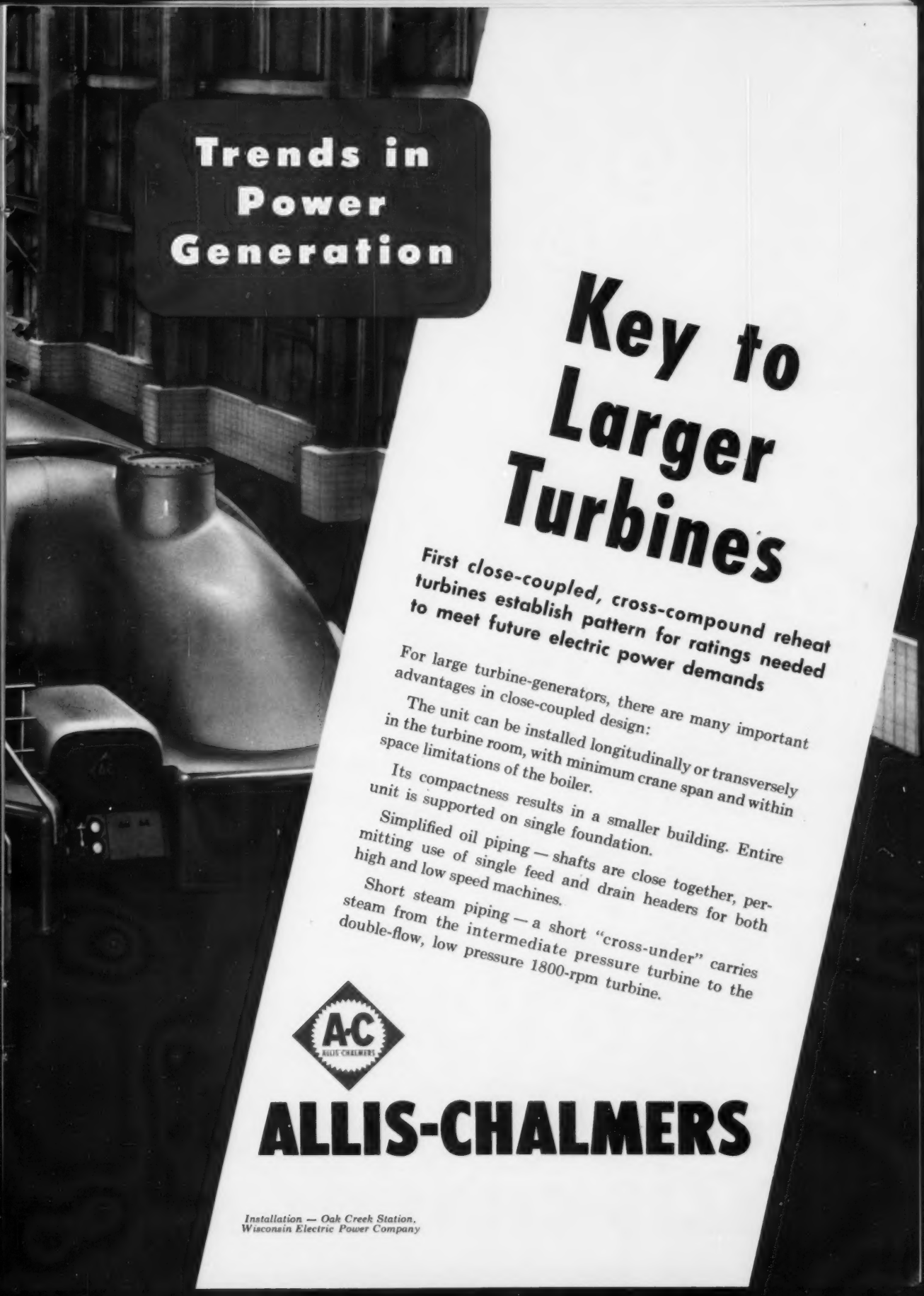
We will be glad to supply you with complete information on units of this type. Call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-4737

ALLIS-CHALMERS
A-C



Trends in Power Generation

Key to Larger Turbines

First close-coupled, cross-compound reheat turbines establish pattern for ratings needed to meet future electric power demands

For large turbine-generators, there are many important advantages in close-coupled design:

The unit can be installed longitudinally or transversely in the turbine room, with minimum crane span and within space limitations of the boiler.

Its compactness results in a smaller building. Entire unit is supported on single foundation.

Simplified oil piping — shafts are close together, permitting use of single feed and drain headers for both high and low speed machines.

Short steam piping — a short "cross-under" carries steam from the intermediate pressure turbine to the double-flow, low pressure 1800-rpm turbine.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

Installation — Oak Creek Station, Wisconsin Electric Power Company

Choose Condenser Shape to Simplify Plant Layout

Get high operating efficiency of Multi-Steam-Path Condensers in Round, Oval or Rectangular shape

This adaptability of Allis-Chalmers condenser design adds flexibility to plant layout without sacrifice of efficiency. This means freedom for you in planning future power stations.

Multi-steam-path design makes all tubes completely effective by directing the steam to even the remote sections of the condenser, thereby producing a high vacuum.

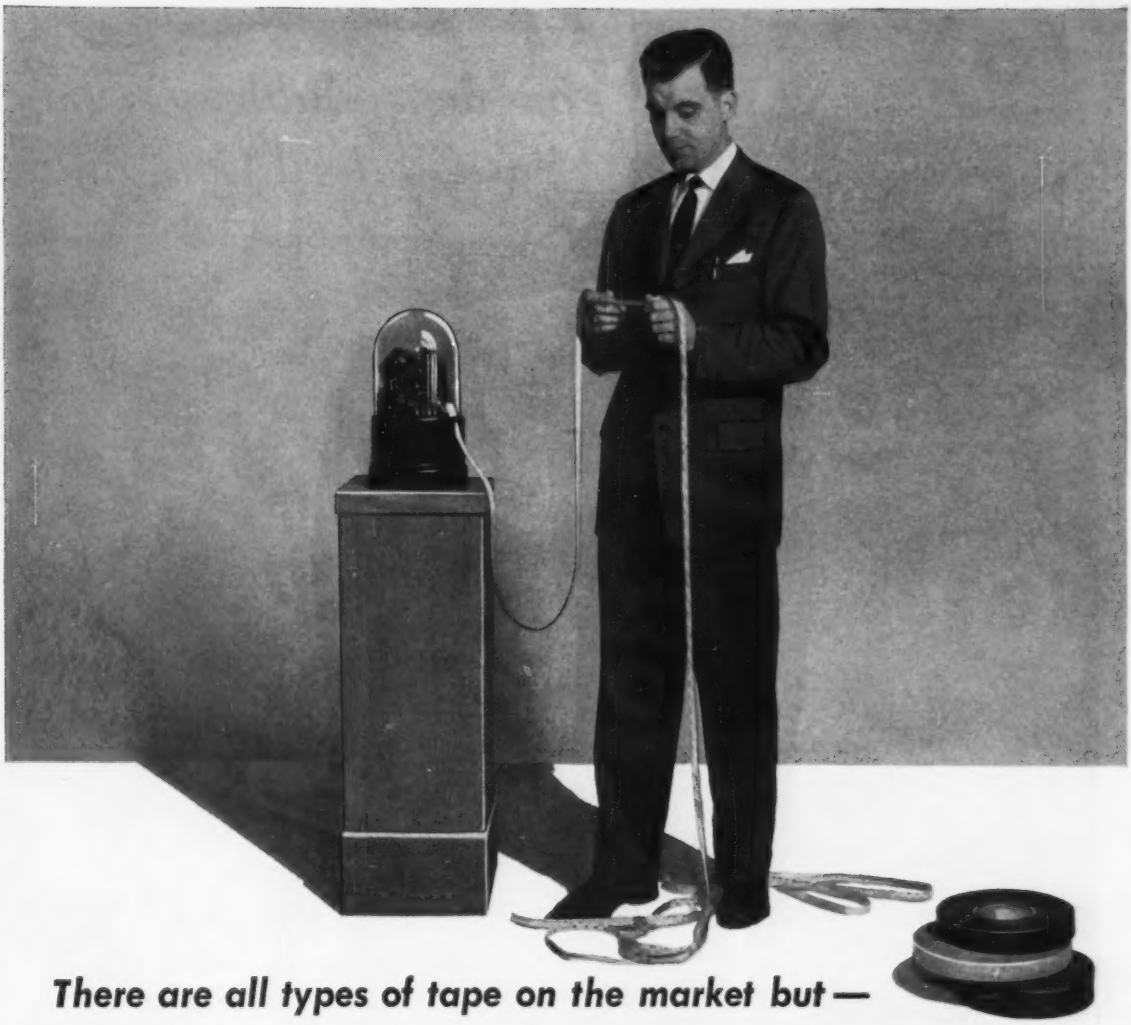
Steam, penetrating all parts of the condenser, keeps condensate temperature high and drives off dissolved oxygen.

This combination of high vacuum, high condensate temperature and good deaeration means high operating efficiency.

Talk over the special requirements you have in mind for future stations with Allis-Chalmers engineers. Call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS



There are all types of tape on the market but —

CHASE TAPES ARE YOUR BEST INVESTMENT!

Chase electrical tapes do not vary from day to day . . . because they are consistently made to the highest specifications . . . of the best materials available. Chase tapes are engineered to meet the most exacting of electrical requirements . . . by specialists who take pride in making the best cable tapes and electrical insulating materials on the market.

The industry has diversified requirements . . . so Chase tapes are made in a very wide range of materials to meet them. Whatever your needs . . . binding, insulating, ozone resistance, etc. . . . you can find a Chase tape to do the job.

Attach the check list to your letterhead for detailed information on the type of tape you need . . . and send to CHASE & SONS, INC., RANDOLPH, MASSACHUSETTS

CLIP TO YOUR LETTERHEAD AND MAIL TODAY!

Please send Chase Electrical Insulation File. I am especially interested in:

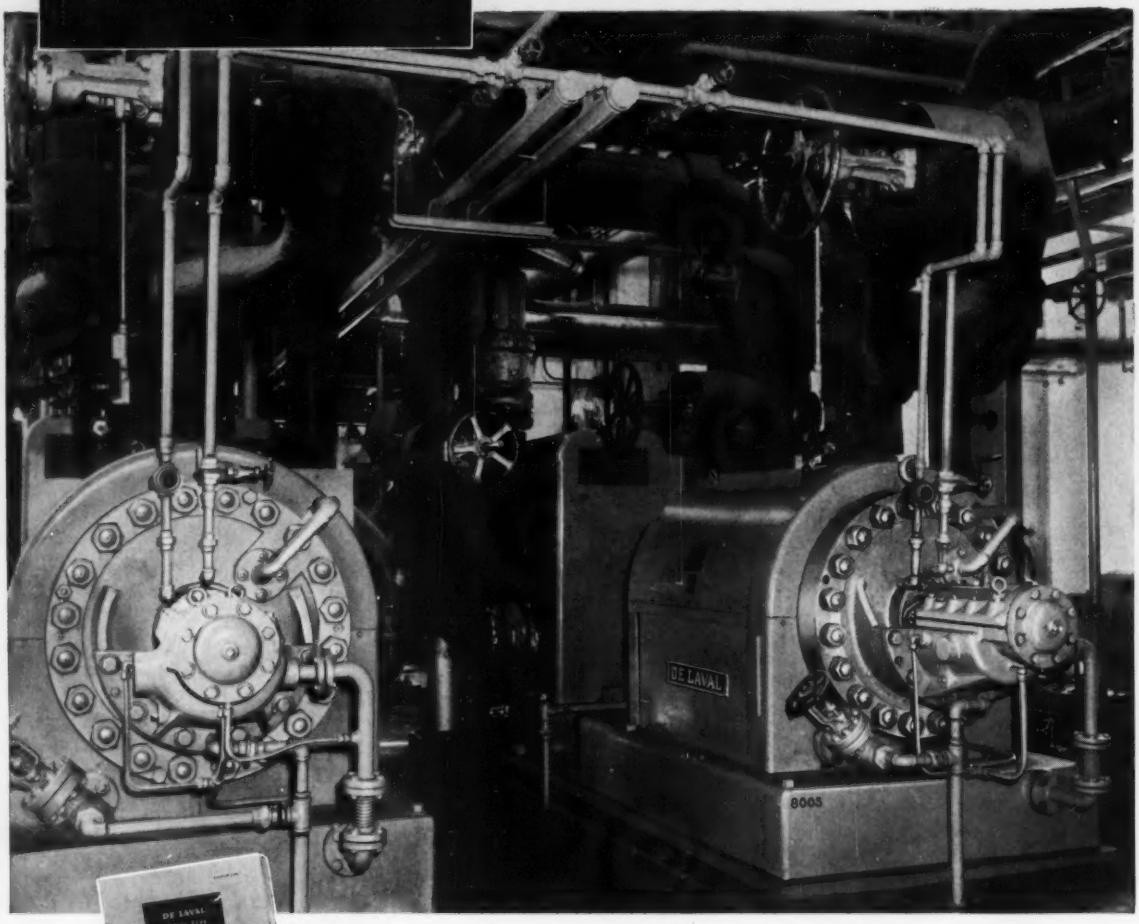
- ☐ Insulating Tape
- ☐ Binder Tape
- ☐ Jacket Tape
- ☐ Moisture Seal Tape
- ☐ Neoprene Tape
- ☐ Flame Retardant Binder
- ☐ Conductivity
- ☐ Ozone Resistance

CHASE

ELECTRICAL INSULATING TAPES AND MATERIALS

DE LAVAL
BARREL TYPE BOILER FEED PUMPS

give dependable service at Gaylord Container



Bulletin contains helpful data

Bulletin 1506 on the De Laval barrel type boiler feed pump covers all major design points... has cross-section cutaway illustration for easy reference. Write for your copy.

Here's additional proof of De Laval reliability on the line in the Bogalusa, La. plant of the Gaylord Container Corporation. These two De Laval barrel type boiler feed pumps are both driven by De Laval MCP turbines operating at 850 psi, with steam temperature at 825 F.

• De Laval barrel type boiler feed pumps are widely used by industrial plants and public utilities. They operate at pressures up to 5,500 psi. These units offer many important design advantages, such as double volute diaphragm, individual diaphragm bolting, positive sealing between suction and discharge chamber and bare shaft construction. Their dependability is proven by year-in, year-out service.

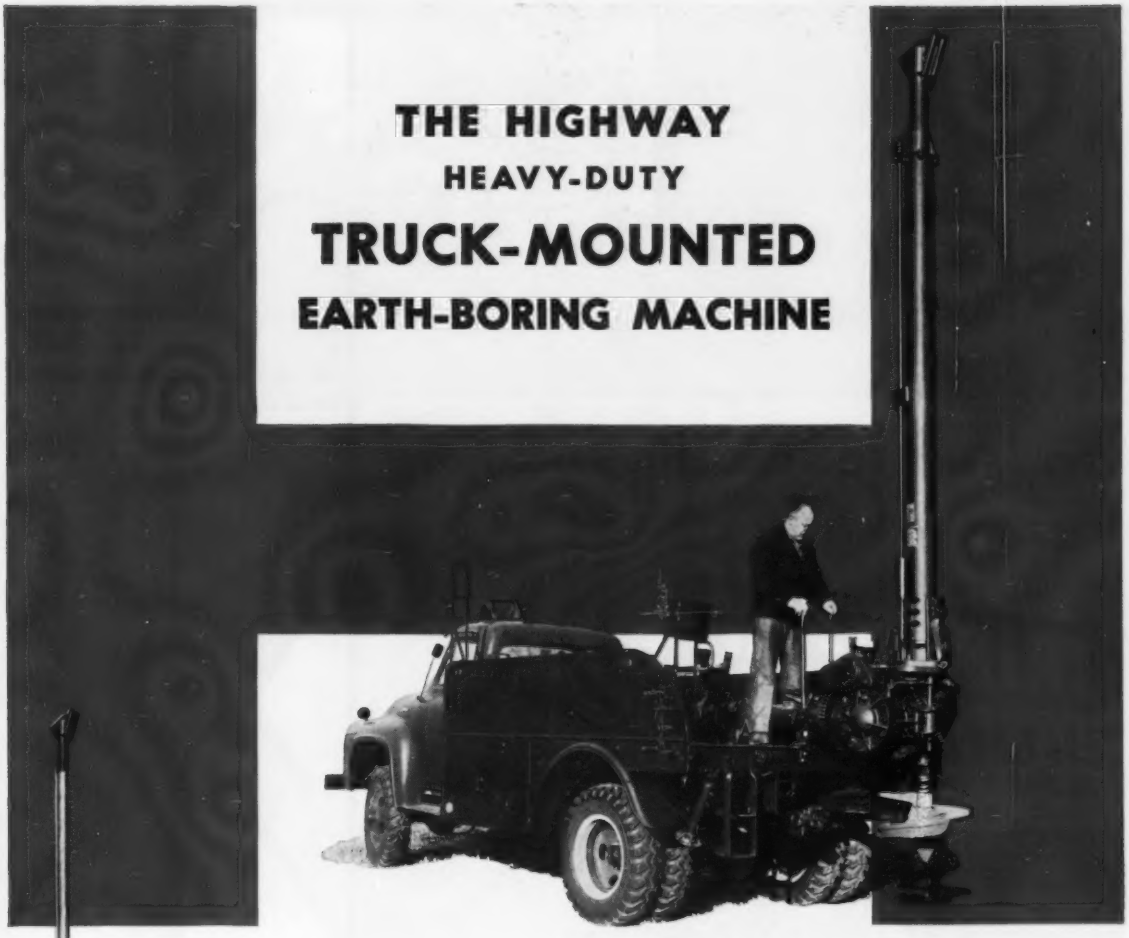
DE LAVAL *Boiler Feed Pumps*

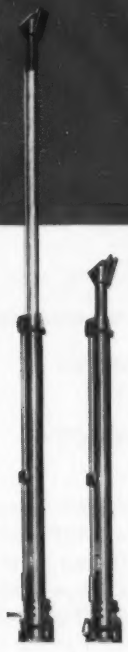
DE LAVAL STEAM TURBINE COMPANY

861 Nottingham Way, Trenton 2, New Jersey

DL 928

THE HIGHWAY
HEAVY-DUTY
TRUCK-MOUNTED
EARTH-BORING MACHINE





Exclusive!

Highway's Telescoping Derrick

The telescoping derrick, 3500-lb capacity, can be extended to more than one-half its collapsed length. Available as optional equipment on the Model "HC" machine.

Modern . . . Rugged . . . Versatile . . . Efficient . . .

digs at any angle up to 90° in *any* soil condition — even rock when equipped with special auger . . . convenient controls . . . sets big poles

The Highway "HC" earth-boring machine is designed and built rugged and sturdy, for tough daily use. The power-operated "HC" can be quickly adjusted to dig at any angle up to 90° — auger bar and pole derrick raised from traveling to working positions by power. Light enough for mounting on a minimum 16,000-pound G. V. W. truck, the "HC" digger requires only 7 square feet of platform space. Convenient controls are easily accessible and Highway design provides complete safety for both operator and machine.

The "HC" earth borer digs holes from 9 to 36 inches in diameter, up to 10 feet deep. A 2500-lb. capacity winch and pole derrick (optional equipment) can handle 40' to 45' poles.

HIGHWAY TRAILERS

HIGHWAY UTILITY DIVISION

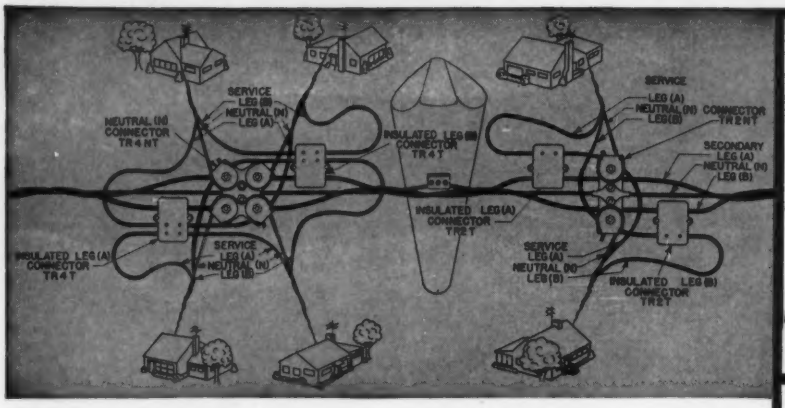
HIGHWAY TRAILER COMPANY

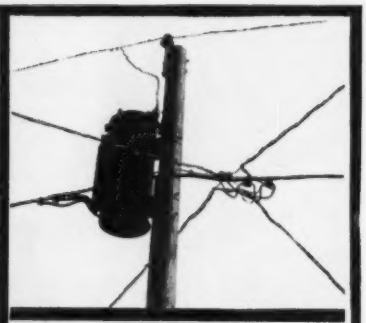
HEADQUARTERS: EDGERTON, WISCONSIN

Manufacturers of

Public Utility Bodies • Earth-Boring Machines • Pole and Cable Reel Trailers • Winches • Power Take-offs • Service Accessories • Commercial Trailers • Trailerized Tanks and Dry Bulk Haulers

SALES AND SERVICE IN PRINCIPAL CITIES


SERVICE LEG (B) NEUTRAL (N) LEG (A)
NEUTRAL (N) CONNECTOR TR4NT
INSULATED LEG (B) CONNECTOR TR4T
SERVICE LEG (A) NEUTRAL (N) CONNECTOR TR2NT LEG (B)
SECONDARY LEG (A) NEUTRAL (N) LEG (B)
INSULATED LEG (A) CONNECTOR TR4T
SERVICE LEG (A) NEUTRAL (N) LEG (B)
INSULATED LEG (A) CONNECTOR TR2T
SERVICE LEG (A) NEUTRAL (N) LEG (B)
INSULATED LEG (B) CONNECTOR TR2T



A complete 4 service TRIPL-X-TAP unit with type GTC connectors used as secondary feeder taps. †

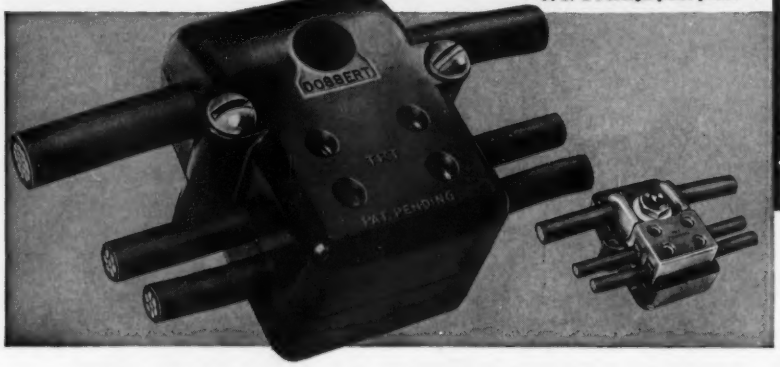
Dossert leads the industry again with the NEW

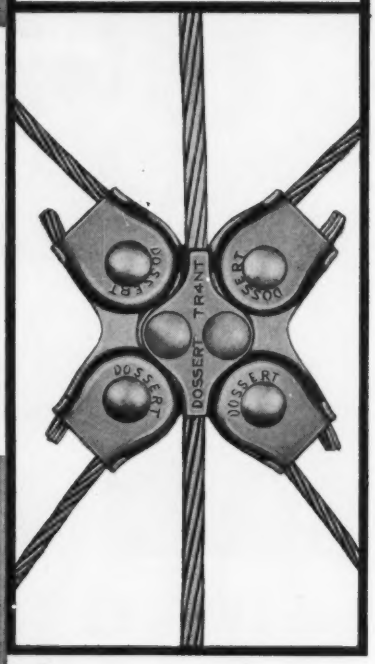
TRIPL-X-TAP*

3-UNIT CONNECTOR

FOR SELF-SUPPORTING SECONDARY AND SERVICE DROP CABLE

*U. S. & Foreign pats. pend.





NEUTRAL CONNECTOR

INSULATED CONNECTOR

Forget about hand-taping . . . about complicated residential hook-ups!

Dossert's new TRIPL-X-TAP 3-Unit Connector—for conductors of copper or aluminum or both—saves labor and installation costs . . . insures the most dependable connections possible.

TRIPL-X-TAP or its components can also be used on open wire systems.

Two Insulated Connectors plus a Neutral Connector comprise the compact, low cost TRIPL-X-TAP "package". No need to remove insulating cover for subsequent connects or disconnects. No secondary spool racks or costly extra hardware. TRIPL-X-TAP installations insure positive electrical joints and through use of supporting neutrals guarantee mechanical permanence. The insulated connector housing is made of high strength, high impact Bakelite composition, affording better insulation and protection. †Courtesy of Long Island Lighting Co.

50 YEARS OF TECHNICAL KNOW-HOW

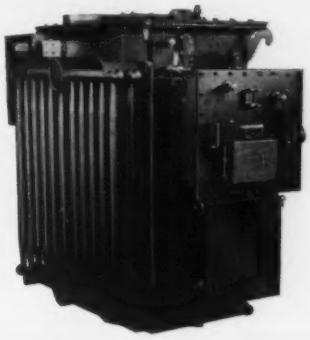
Write for details and prices today.

DOSSERT MANUFACTURING CORP.

249 Huron Street, Brooklyn 22, N. Y.

Exclusive Canadian Dist.: W. S. Gerrie & Assoc. Ltd. • 4158 Dundas St. West, Toronto 18, Ontario, Canada

The engineering design of Uptegraff Distribution Transformers, representing the most advanced practices, assures dependability of this 500 KVA, 34.4 KV unit.



Uptegraff Network Transformer, type NADT, 300 KVA, for urban underground network systems.

ratings . . . . . efficiencies

dimensions . . . . . performance data

accessories . . . . . terminal arrangements

weights . . .

New, useful engineering data on Uptegraff Station-Type distribution transformers

May we send you a free copy of the new bulletin illustrated above? It contains detailed specifications and complete data on Uptegraff liquid filled distribution transformers, 150 to 500 KVA inc. The ratings, performance data, dimensions, weights and other information will be found useful in planning new power systems or in extensions and modernization of present equipment. Outline drawings give all critical dimensions for single phase or three phase transformers, oil and askarel immersed. Various terminal arrangements are shown, and terminal dimensions are given in detail.

We will be glad to send you a free copy.

R. E. Uptegraff Manufacturing Co.
Scottdale, Pennsylvania

R. E. UPTEGRAFF MANUFACTURING CO. (EW)
Scottdale, Pennsylvania

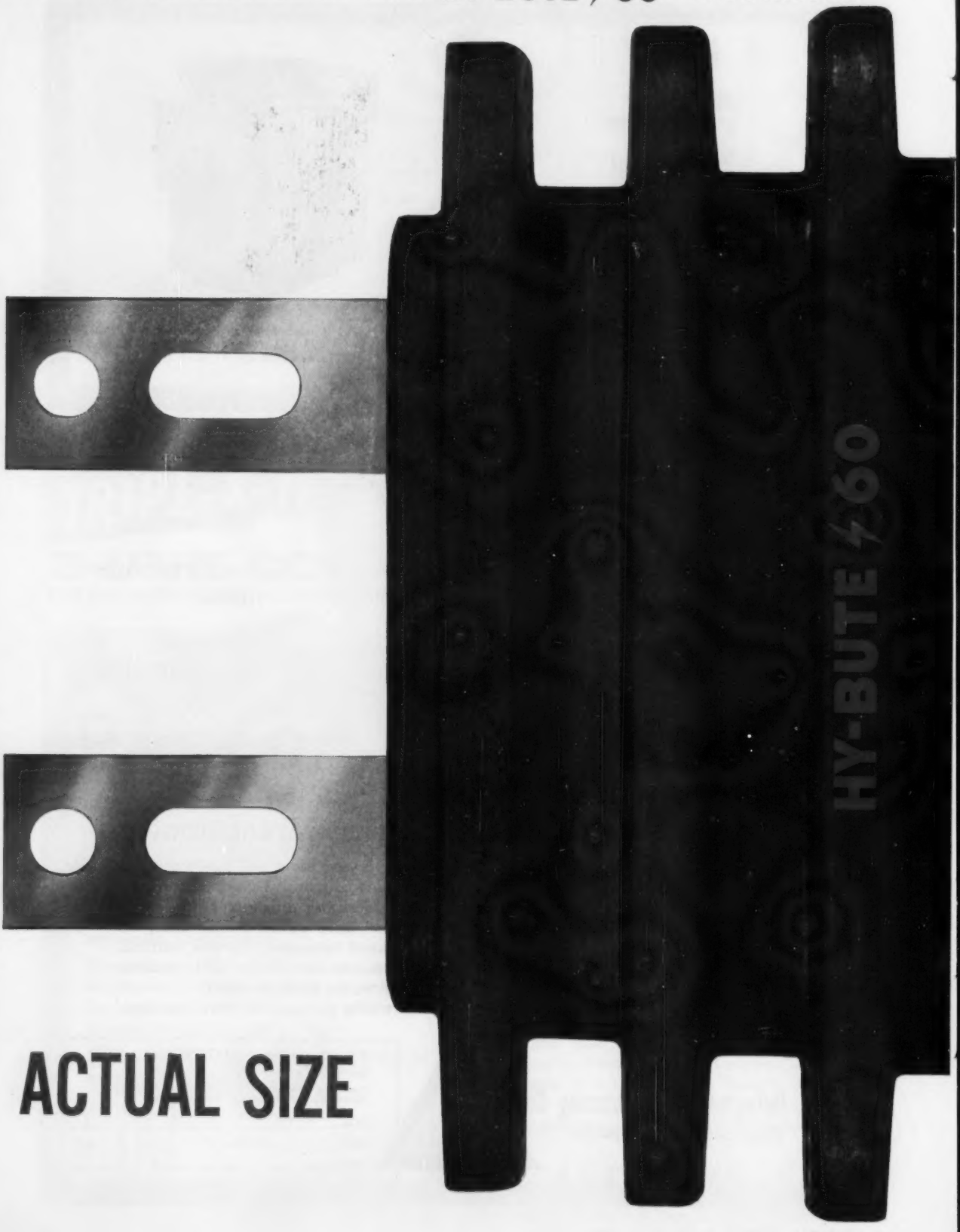
Please send a free copy of your New Bulletin describing DISTRIBUTION TRANSFORMERS, Bulletin 136 to:

Name_____

Title_____ Company_____

Address_____

FIRST TO BE MOLDED IN NEW HY-BUTE ⚡60* INSULATION



ACTUAL SIZE

G.E.'s New 15-kv Instrument Transformer Mounts Easily; Needs Less Maintenance

LIGHT AND MORE RUGGED, TYPE JKW-5 MOUNTS IN ANY POSITION

General Electric's discovery of an internal oxidation mechanism which can be added to ordinary butyl to prevent arc-tracking now makes feasible the molded construction of outdoor current transformers in the higher voltage ranges. This new compound, Hy-Bute/60 insulation, gives you seven big advantages in the new type JKW-5 15-kv instrument transformer.

NEW JKW-5 REPLACES 3 TRANSFORMERS because it can be mounted in any position. It supersedes the bottom, top and side-connected designs. This simplifies stocking and maintenance problems.

CORROSION-RESISTANT materials—new Hy-Bute/60 insulation, stainless steel and copper—virtually eliminate necessity for maintenance.

WEIGHS 20% LESS than older type, top connected transformer of the same rating.

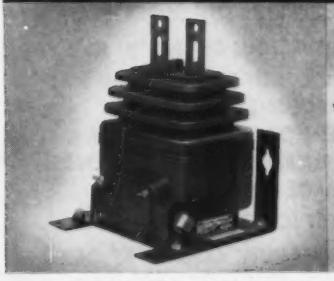
SMALLER SIZE coupled with lighter weight makes the General Electric JKW-5 easier to install. The new transformer, shown here in actual size, measures only 15¾ inches high, 10⅞ inches wide and 9½ inches long.

NO PORCELAIN BUSHINGS to crack because new Hy-Bute/60 serves as bushing, insulation and case on the new JKW-5. This feature removes possibility of failure which might occur as a result of thermal shock or external damage to porcelain bushings.

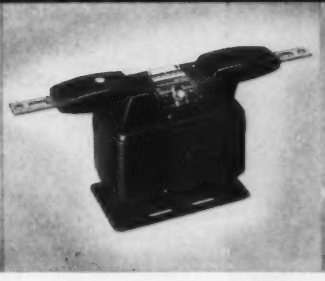
SAFER OPERATING, General Electric's Hy-Bute/60 insulated transformers cannot explode or catch on fire like older types.

LONGER LIFE is assured because Hy-Bute/60 insulation is mechanically tough, chemically inert, heat resistant, impervious to severe weather conditions and has high dielectric strength.

YOU GET SIMILAR BENEFITS IN OTHER MEMBERS OF G.E.'S BUTYL FAMILY



JKW-3 5-kv current transformer is available for outdoor applications



JKM-5 15-kv current transformer for indoor applications

JCP-0 600-volt current transformer for high-current indoor/outdoor applications

For more information about the new JKW-5, contact your nearest G-E Apparatus Sales Office or write for Bulletin GED-2727 to Section 581-2, General Electric Company, Schenectady 5, New York. For information about General Electric's complete line of instrument transformers, request Bulletin GEC-1028. 581-2

*Trade-mark of General Electric Co.

GENERAL ELECTRIC

ROEBLING PAPER POWER CABLE WITH TELLURIUM LEAD ALLOY SHEATH

YOU WANT

- *MAXIMUM FATIGUE RESISTANCE;*
- *SUPERIOR STABILITY UNDER HEAT;*
- *HIGH BURSTING STRENGTH;*
- *ABOLITION OF THE NEED FOR FREQUENT STOP JOINTS, REINFORCED LEAD SHEATH, GENEROUS EXPANSION BENDS, LARGE MANHOLES;*
- *LOWEST LONG-TIME CREEP RATE;*
- *THE RELIABILITY ASSURED BY OUR EXCLUSIVE MANUFACTURING, TESTING AND FIELD EXPERIENCE...*

IN SHORT,

YOU WANT

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 11-15 STILLING ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13235 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1930 E. 2ND ST. • PHILADELPHIA, 330 VINE ST. • PITTSBURGH, 1723 HENRY W. OLIVER BLDG. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6, N. Y.

Get Voltage Data the Continuous Low-Cost Way with Lincoln Voltmeters

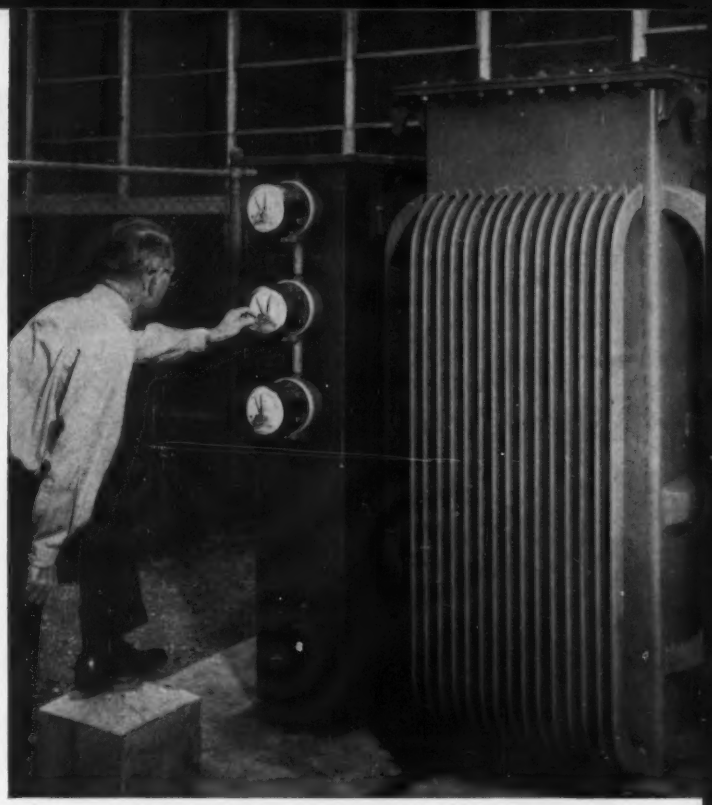
You can't give proper service without proper voltage. And rapid load growth has made expensive, periodic surveys unreliable.

Permanent installations of Lincoln *Indicating* Voltmeters provide a constant record of maximum and minimum voltages for all interested personnel at low capital investment.

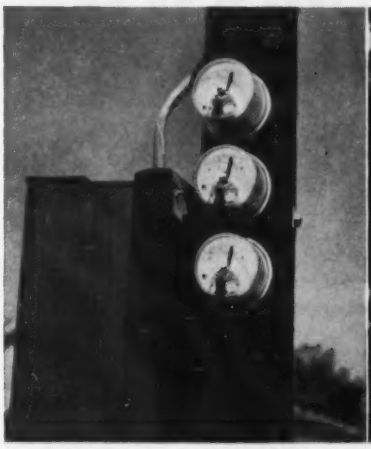
Lincoln *Graphic* Voltmeters are available for use where more detailed information of time and duration of voltage is required.

Get the whole story—write for "Solving Distribution System Problems through Measurement."

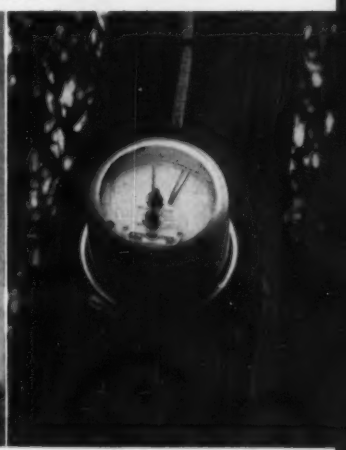
SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS



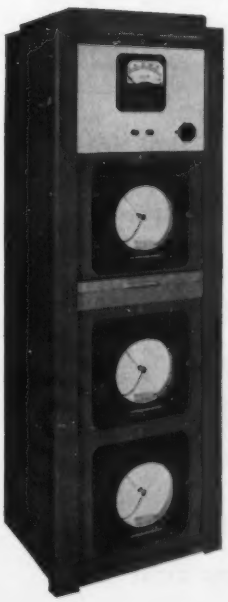
Voltage and current in this three phase transformer are being measured with a Lincoln V2S Voltmeter and two Lincoln ADS Ammeters.



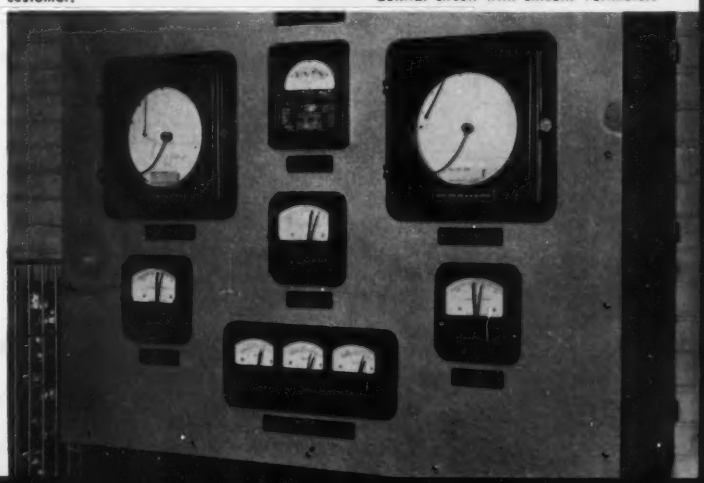
Three V2S Voltmeters check supply voltage at metering point to an industrial power customer.



Minimum and maximum voltage continuously checked on singlephase residential circuit with Lincoln Voltmeter.

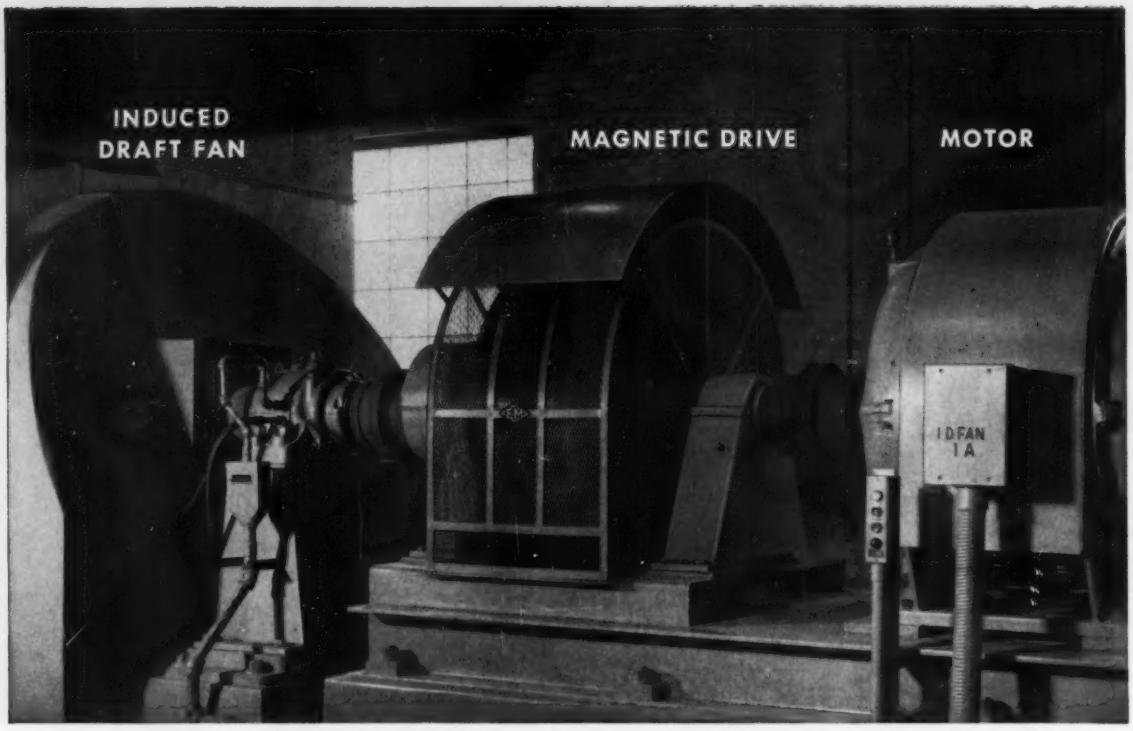


Lincoln graphic voltmeters with monthly charts tell operating manager of phase voltages at primary substation.



Complete information is obtained on circuit conditions with Lincoln meters measuring watts, vars, amperes, and volts.

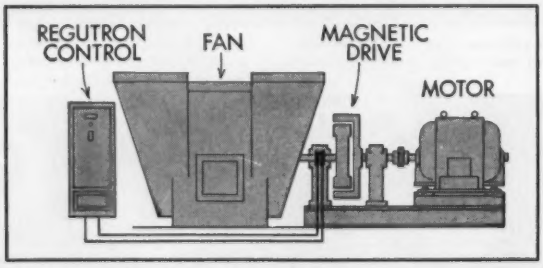
SM36-4



Now 20 E-M Magnetic Drives for Potomac Electric Power Company

● The clean, compact E-M Magnetic Drive above gives adjustable speed for an induced draft fan at the Potomac Electric Power Company Buzzard Point plant, Washington, D.C. This Drive is rated at 550 hp, 850/90 rpm. The first Magnetic Drives were installed by this large, rapidly growing utility in 1941.

These E-M Magnetic Drives transmit torque electromagnetically from constant-speed a-c drive motors to vary the speed of the fans. The Magnetic Drive responds precisely to the speed dictated by the automatic combustion control.



E-M MAGNETIC DRIVE SYSTEM for induced draft fan speed control consists of a constant-speed motor, the Magnetic Drive, and the E-M "Regutron" Speed Control. Operating speed of the "magnet" coupled to the fan shaft is held at the desired value by the "Regutron" which supplies d-c excitation to the "magnet" in accordance with the demands of the combustion control system.

Among the advantages of Magnetic Drive speed control you will find:

1. **Savings in Driving Power.** Because fan operating speed is no more than required, drive power is used most sparingly.
2. **Reduced Blade Erosion.** When boiler load is reduced and fan speed is reduced accordingly, "sand blasting" effect on the blades by airborne particles is reduced to a minimum.
3. **Precise Control of Air Flow.** The E-M Magnetic Drive maintains fan speed to within plus or minus *one-half percent!*
4. **Easy and Economical Maintenance.** The Drive and its control contain few moving parts. It is simple to understand and requires little maintenance. No auxiliary cooling equipment needed.

Ask your nearest E-M sales engineer for more facts and figures on this simple, economical method of driving draft fans. And write the factory for E-M Publication No. 1107 containing pictures and data on typical Magnetic Drive applications.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

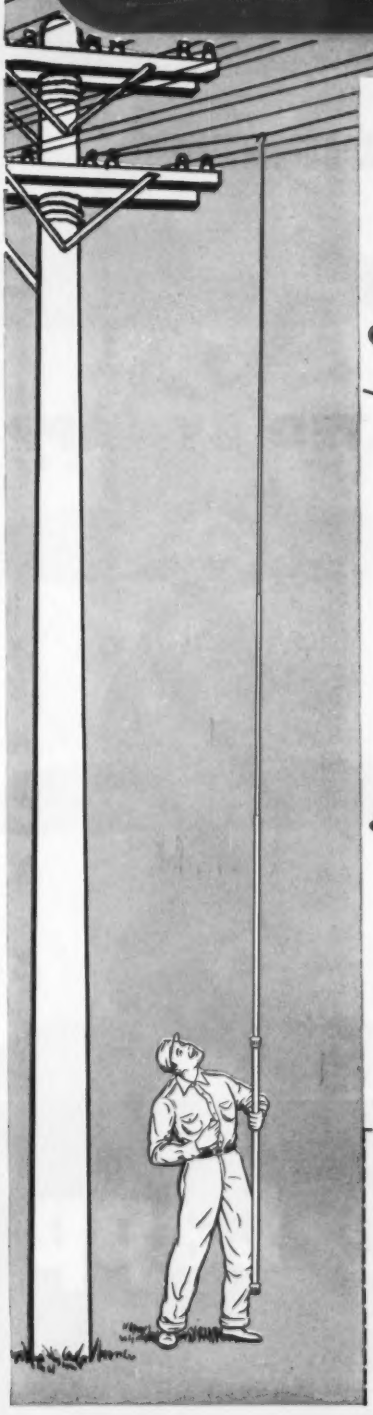
4400-TPA-2151

E-M

Magnetic Drives **MAKE DRAFT FANS DO EXACTLY WHAT YOU WANT THEM TO**

NEW! BY THE MAKERS OF Actionrod FISHING TACKLE—

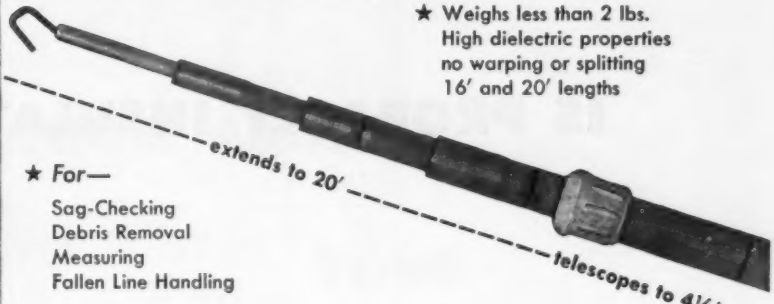
EXTENDO Fiberglass POLES



LIGHT . . . SAFE . . . CONVENIENT . . . DURABLE

Called by many the biggest improvement in line-handling tools in years, the EXTENDO fiberglass utility pole is an adaptation of the famous Extendo fishing rod. Light weight, compact, easy to carry and store, the Extendo is saving time and money for maintenance men throughout the country.

EXTENDO *Sag-Tester*



★ Weighs less than 2 lbs.
High dielectric properties
no warping or splitting
16′ and 20′ lengths

★ For—
Sag-Checking
Debris Removal
Measuring
Fallen Line Handling

EXTENDO *"Hot Stick"*

★ Weighs less than 7 lbs.
★ 24′ and 28′ lengths
★ High dielectric properties

★ Universal Head takes standard "fit-on" tools
★ Sections lock securely for both push and pull operations

Order* EXTENDO *Samples Today!

To: Orchard Industries, Inc., Hastings, Mich.
Gentlemen:
Please rush full information about your EXTENDO Fiberglass Poles.
Enclosed is our purchase order for samples.

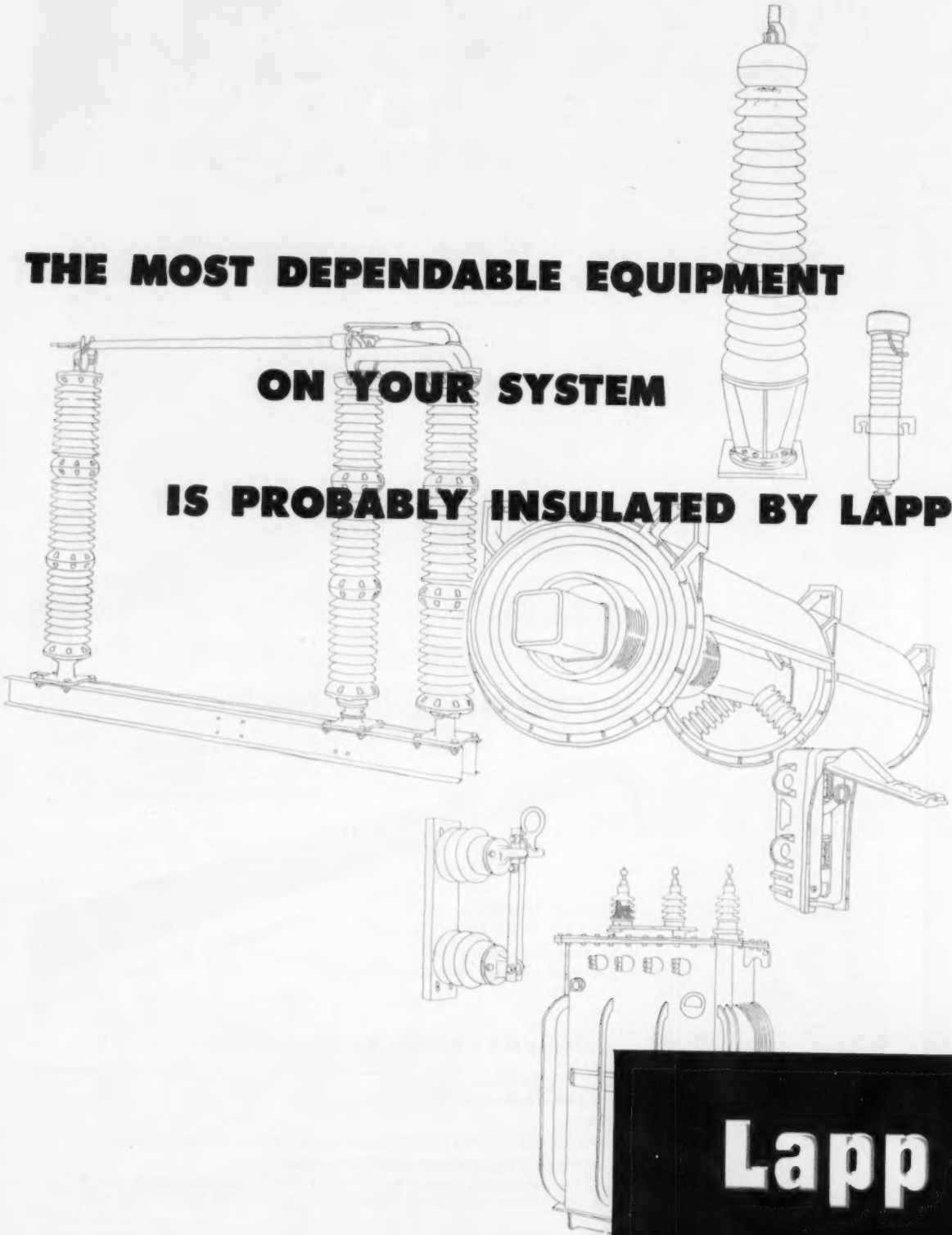
( ) 16′ Extendo Sag Tester @ $17.50
( ) 20′ Extendo Sag Tester @ $25.00
( ) 24′ Extendo Hot Stick @ $64.50
( ) 28′ Extendo Hot Stick @ $78.50

Co. Name_____
City_____ State_____
By_____ Pos._____

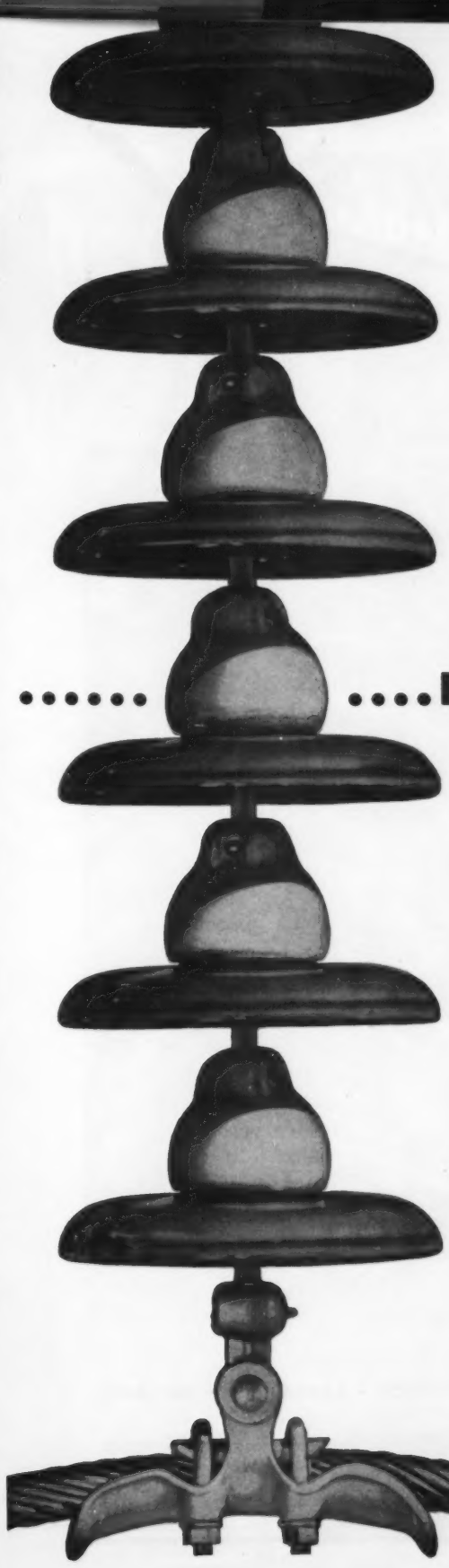
THE MOST DEPENDABLE EQUIPMENT

ON YOUR SYSTEM

IS PROBABLY INSULATED BY LAPP....



Lapp



....HOW ABOUT

YOUR

TRANSMISSION LINES?

Manufacturers of the best in switches, transformers, lightning arresters, fuse boxes, and other high-voltage electrical equipment look to Lapp for insulators and "special porcelain" insulating components. That's because they know porcelain-and-metal assemblies produced by Lapp offer an extra margin of operating security . . . long life . . . and low upkeep. Lapp porcelain adds value, because it adds dependability, to such equipment.

The porcelain-and-metal assembly of which Lapp has made more units than any other, is the 10" suspension disc. This "simple design" has had more research and testing than anything else we have ever worked on.

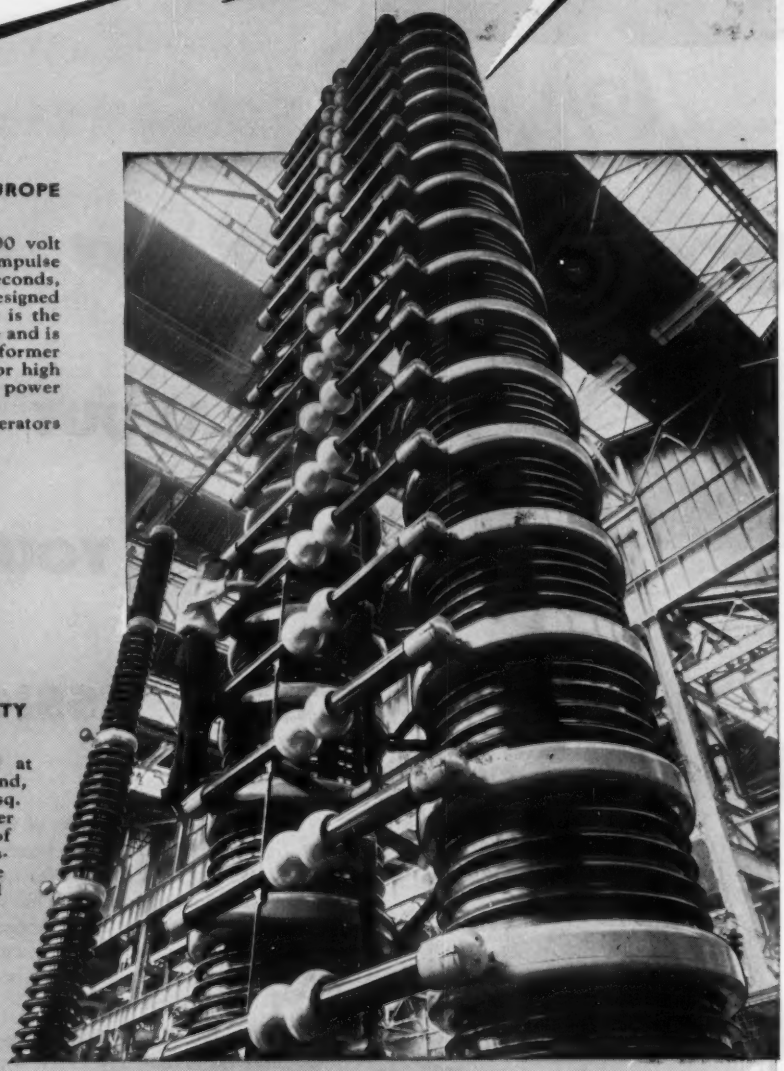
We know, as do hundreds of power companies, that there's no surer way to build security and long service into a transmission line than to hang it on Lapp suspension insulators.

Lapp Insulator Co., Inc., Le Roy, N. Y.

4,000,000 VOLTS!

THE LARGEST
IMPULSE GENERATOR IN EUROPE

The illustration shows a 4,000,000 volt 18 stage, 2 column Ferranti Impulse Generator, energy rating 285 kW seconds, D.C. charging 220 kV per stage. Designed and built by Ferranti engineers, it is the largest impulse generator in Europe and is now installed in the Ferranti Transformer Factory at Hollinwood, England for high voltage impulse testing of large power transformers.
Ferranti High Voltage Impulse Generators are used throughout the world.



OVER 5,000,000 kVA
per annum
of TRANSFORMER CAPACITY

The Ferranti transformer plant at Hollinwood, Lancashire, England, covering an area of over 300,000 sq. ft. has a manufacturing capacity per annum of over 5,000,000 kVA of Large Power Transformers, Distribution Transformers, Voltage Regulators, High Voltage A.C. and D.C. Impulse Testing Plant and Specialised Equipment. Contracts include the supply of transformers for the Garrison Dam and McNary Dam Projects in the U.S.A. and the Alcan Project in Canada.

FERRANTI LTD

Head Office and Plant: **HOLLINWOOD · LANCASHIRE · ENGLAND**

OFFICES AND PLANTS

NEW YORK · Ferranti Electric Inc., 30 Rockefeller Plaza, N Y 20
TORONTO: Ferranti Electric Ltd., Mount Dennis, Toronto 15, Ontario
MANCHESTER, ENGLAND: Ferranti Ltd., Moston, Manchester 10
EDINBURGH, SCOTLAND: Ferranti Ltd., Ferry Road, Edinburgh 5

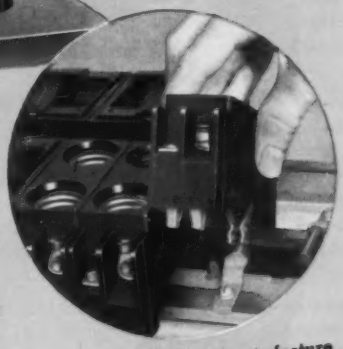
FT 176/2

It's a Scoop! FUSIBLE SERVICE EQUIPMENT with *PLUG-IN* FLEXIBILITY!

How well you know it—service entrance requirements have skyrocketed! More circuits needed! A greater variety of circuit combinations needed! This has been the problem—how to get the device with exactly the right combination of circuits, when you need it. Now, Square D gives you the answer—**plug-in fusible circuits!**

Square D offers you two new basic devices, one with space for 28 circuits—the other, 40. Both devices have a 200 ampere main pullout.

Boxes, interiors and fronts, as well as packaged plug-in units (plug fuse or pullout types) are available off-the-shelf from your Square D distributor—right now!



All plug-in units feature Square D's exclusive *SWINGRIP* mounting—easy, speedy installation, automatic alignment and positive contact with bus bars.

Write for Bulletin SD-36. Square D Company, 6060 Rivard Street, Detroit 11, Michigan.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

Hotpoint

Electric Water Heaters

With Performance and Features That Build Preferred Acceptance ... and Utility Revenue!

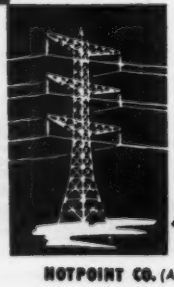
Almost *one-third* of the electric water heaters in use today were manufactured by Hotpoint—positive proof that Hotpoint has the acceptance that helps build *your* revenue!

Take advantage of this constantly growing preference. Promote Hotpoint Water Heaters . . . the *pre-sold* line that promotes acceptance through forceful national advertising . . . and helps *you* promote with a hard-hitting, *local* merchandising program designed specifically for utility use!

Learn all the facts about Hotpoint Automatic Electric Water Heaters from your local Hotpoint Distributor. He will be happy to help you build assured revenue for the future with Hotpoint.

- **Hotpoint Water Heaters are available in a full range of sizes, in both round and table-top models.**
- **Famous Magic Circle® Heat—Calrod® heating units transmit heat to the water by conduction—the most direct and efficient method.**
- **New Low Prices—lowest in 10 years—help expand your electric water heater market!**
- **New Colortones—table-top models come in 5 colors as well as white!**
- **New Super-Speed—40-gallon quick-recovery models ready for shipment.**

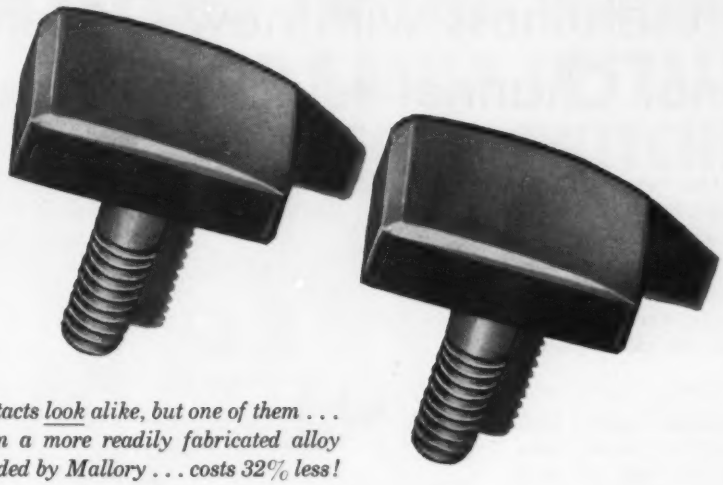
Again, Hotpoint



looks at Tomorrow, Today!

HOTPOINT CO. *(A Division of General Electric Company)* **5600 West Taylor Street, Chicago 44, Illinois**

MALLORY



These contacts look alike, but one of them . . . made from a more readily fabricated alloy recommended by Mallory . . . costs 32% less!

Mallory Engineered Materials Selection Can Cut Your Contact Costs

Mallory Contact Engineering Offers Five Ways To Improve Economy

1. **The most effective contact material** from the extensive line developed by Mallory. More economical alloys often can satisfy *actual* service conditions.
2. **The most economical contact design** . . . for your purchasing, production and product needs.
3. **The most economical backing material** . . . from a group of Mallory alloys developed for this use.
4. **The most economical backing member design** . . . in relation to contact and product design requirements.
5. **The most economical method of assembly** of contact and backing member.

By coordinating *all* these important elements of contact design, Mallory can help you put into effect a long-range plan for cutting contact cost and assuring peak performance.

CHOOSING the contact material that exactly matches your product requirements can often reduce over-all contact costs. For example, designers of a circuit breaker selected one of the Mallory Elkonite® materials for the contacts. This is a superior material for heavy-duty service, with high resistance to sticking and arc erosion.

Mallory engineers examined the product requirements . . . and recommended a change in materials. They found another ELKONITE, a higher silver content material, would give excellent performance on this medium-duty application. And because this material involved fewer manufacturing operations, the contacts could be made at lower cost. The customer's savings amounted to $10.16 per thousand . . . a total of over $8,000!

Mallory engineers are especially well qualified to help you get the best economy and performance in your contacts. They have a uniquely broad range of Mallory contact alloys from which to choose. And their extensive application experience is valuable in coordinating *all* phases of contact, backing member and assembly design to assure you of top value for your contact dollar. Write or call Mallory for a consultation on your particular application.

Expect more . . . get more from

P. R. MALLORY & CO. Inc.

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

Serving Industry with These Products:

Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical — Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

Cut interference, save air time, multiply radio usefulness with new General Electric Personal Channel selective calling systems

New Progress Line Personal Channel Systems provide two-way radio users with individual calling, automatic recall or "leave a call"—make possible group calling with personal communication between dispatcher and driver after the call is placed.

With G-E Personal Channel individual calling built into two-way radio systems, dispatchers can call each driver—drivers need hear only calls beamed to them. Away from vehicles, drivers may automatically be recalled to the radio by a flashing light or sounding horn. If beyond range of the recall message, a signal automatically remains lighted on the radio control unit until the call is answered.

With a fleet equipped with Personal Channel group calling, drivers hear only calls from their own dispatcher. When the individual called answers the dispatcher, conversations then may become private.

New Progress Line Personal Channel Systems, for individual or group calling, effectively eliminate most of the nuisance interference due to crowded channel conditions. Both systems virtualiy eliminate bothersome "skip" interference from distant stations.

Present users of G-E all-electronic selective calling systems report increases up to one-third in useful air time. The ability to recall, or "leave a call", saves air time previously wasted when dispatchers repeated calls for drivers away from their vehicles.

Your two-way radio dispatcher can call or signal your drivers individually, with a new G-E Personal Channel selective calling system. He pre-selects the individual driver to be called or signalled by means of push buttons. Transmissions, with or without the electronic tones which provide the individual calling or signalling function, are made by pushing either of two push bars on a desk console.

NEW DEPENDABILITY

New G-E Personal Channel Selective Calling Systems now provide the highest possible reliability of operation. A new, simplified, electronic tone receiver selects proper tones in a more exacting manner than ever before. Limits within which the receiver will accept proper tones are dependent upon BOTH amplitude and frequency. The tones accepted must have the right amplitude as well as the right frequency.

Operating ranges of present two-way radio systems are not impaired by the addition of Personal Channel Selective Calling Systems.

All Personal Channel equipment can be incorporated within a single Progress Line mobile unit case, with the same cost-saving, interchangeable plug-in chassis feature provided in all Progress Line equipment.

Your General Electric Communications Counselor is ready now to recommend the G-E Personal Channel two-way radio system which will best serve you. For more information call him, or write: *General Electric Company, Communication Equipment, Section X1936-19, Electronics Park, Syracuse, New York.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

TWO ANSWERS TO THE DEMAND FOR EASILY INSTALLED LOW-COST SWITCHING

TYPE RU-1A or TYPE TR-1A

TENNESSEE — Typical of the installations by utilities from coast to coast is this one of Southern States Type TR-1A Disconnect Switches.

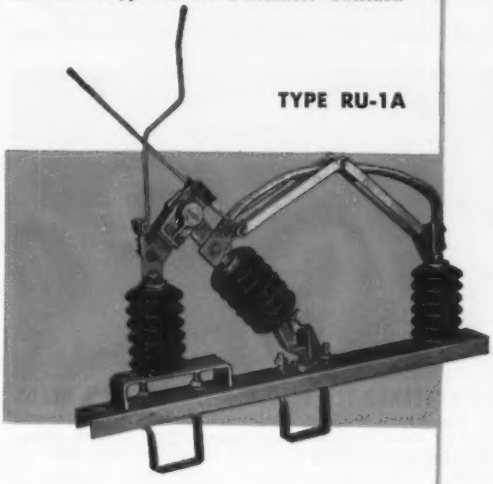
When easy, low-cost installation is the first requirement for disconnecting switches, Southern States offers you not one—but *two* complete lines from which to choose.

The Type TR-1A is a high-quality rocker-type disconnect that meets NEMA standards in every respect. It is available in voltage ratings from 7.5 kv through 69 kv and continuous current ratings of 200, 400, and 600 amps.

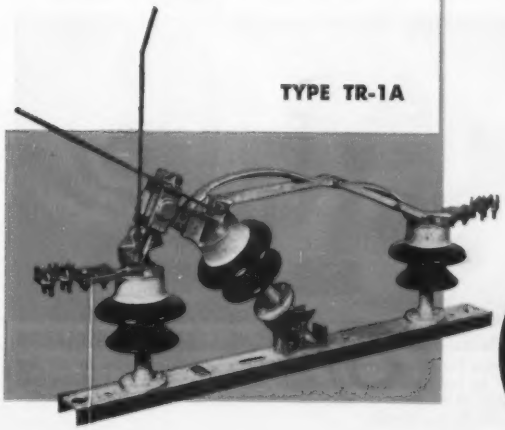
The Type RU-1A is a distribution level rocker-type switch specifically designed for pole-top mounting. Its dielectric strength is the same as standard levels for other distribution equipment, but it is below NEMA standards for power switching equipment. It is available in voltage ratings of 7.5 and 15 kv and continuous current ratings of 200 and 400 amps.

Both types are ruggedly constructed, and will provide reliable switching under all service conditions. Many utilities throughout the nation have found in these switches the answer to their needs for low-cost, easily installed rocker-type, vertical break disconnecting switches. So can you. Get full details in our Bulletins 54RU and 3050.

TYPE RU-1A



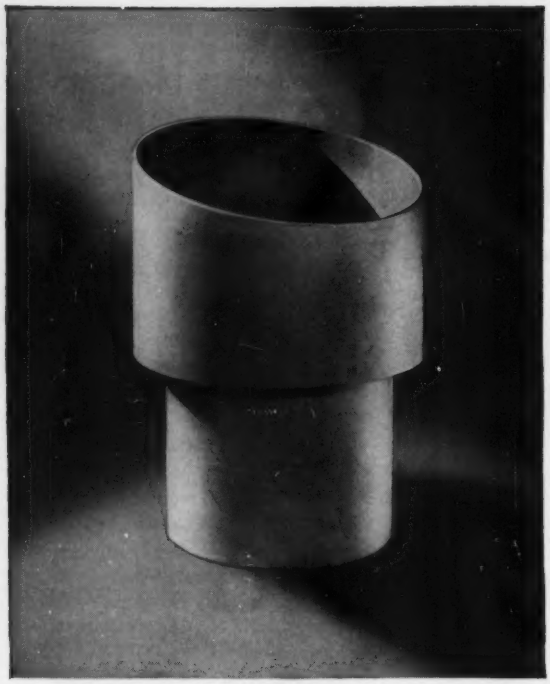
TYPE TR-1A



EASY INSTALLATION—One reason utilities find the installation of these switches so easy is the method for affixing the interphase shaft to the rocking insulator. (See photo) The shaft is laid in its proper position across all three phases and then only one bolt per phase is tightened to complete the installation, saving valuable installation time in the field.

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto



C-D-F HANDLES THE COMPLETE JOB An oil circuit breaker component is made from two Dilecto laminated plastic tubes, with a threaded ring joining the assembly. From raw materials to finish machining C-D-F does it all!

Utilities can depend on equipment containing C-D-F Insulating Parts

The reliable operation and long life of heavy electrical equipment often depends on insulating parts. A good supplier of insulation draws from past experience to make this possible—C-D-F has been a recognized industry leader since 1895! A good supplier expands his research and technical skill consistently—C-D-F offers the *widest range of electrical insulating materials*, from Vulcanized Fibre to C-D-F Products of Teflon.*

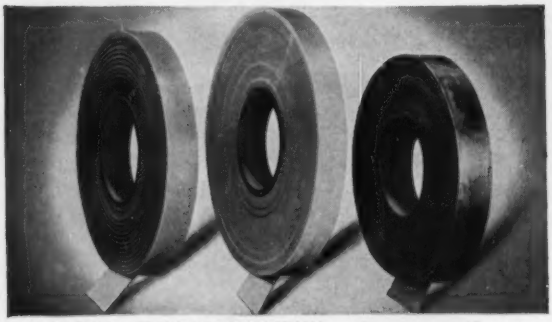
A BIG, RELIABLE SOURCE OF SUPPLY

As a buyer of Utility Electrical Equipment, you gain when your manufacturers work with C-D-F. Quality and dependability of electrical insulation, at reasonable cost, are guaranteed. The latest technical advances and ideas can flow freely between you and C-D-F's engineers. This page shows only a few of the many products C-D-F makes and fabricates for the electrical industry. Consult Sweet's Design File for catalog information, or call your C-D-F sales engineer (sales offices in principal cities)—you'll find he's a good man to know!

*Du Pont Trademark

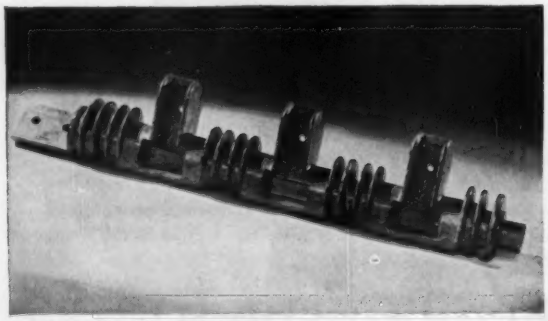
CONTINENTAL DIAMOND FIBRE

CONTINENTAL-DIAMOND FIBRE DIVISION OF THE BUDD COMPANY, INC.
NEWARK 15, DELAWARE



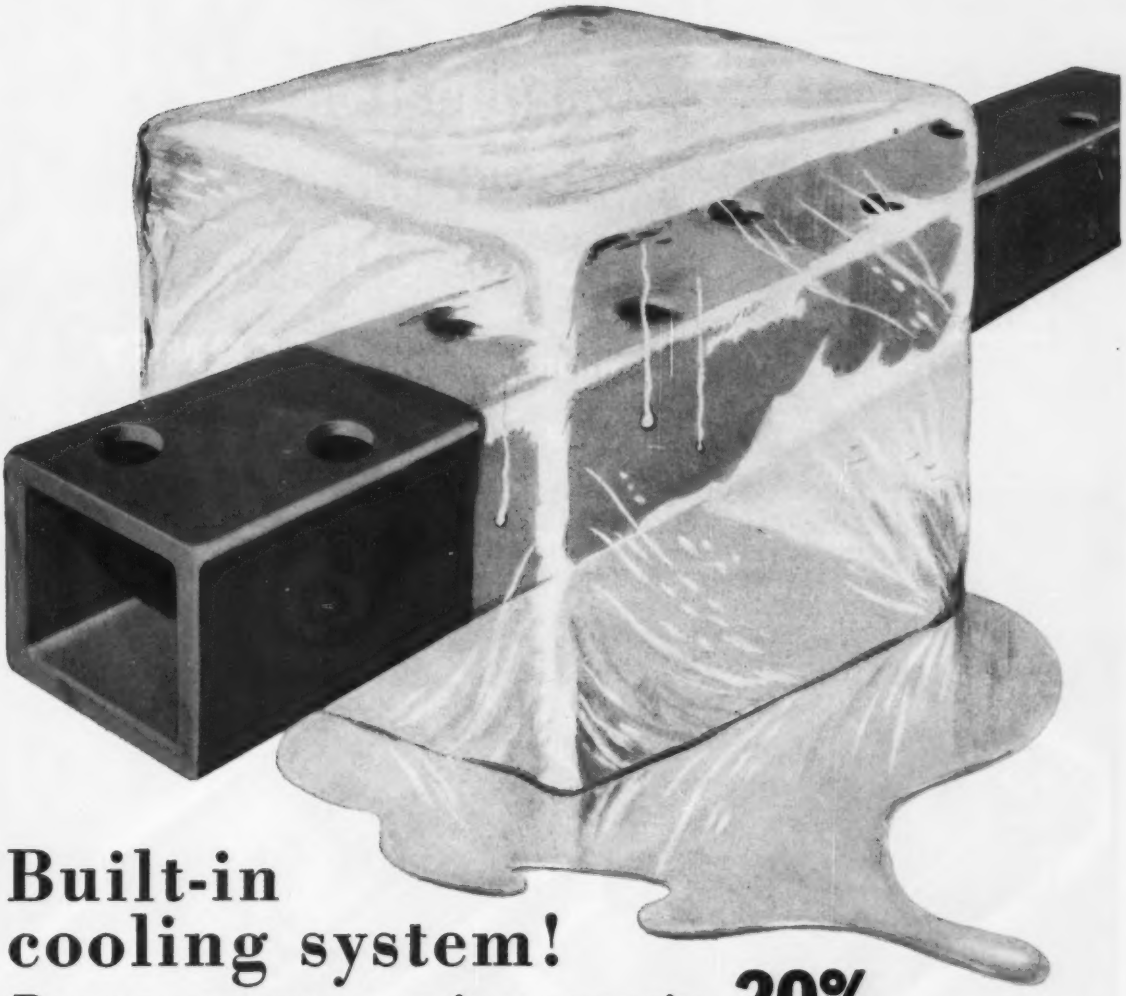
C-D-F MAKES FLEXIBLE INSULATION To meet critical high heat and electrical insulating needs, C-D-F makes these efficient, easy-to-apply tapes. Size range is wide, with latest resins and backing materials used. Write for samples and technical bulletins of Silicone, Teflon, and Micabond tapes.

C-D-F UNDERSTANDS THE ELECTRICAL INDUSTRY'S NEEDS Precisely machined to close tolerances, Dilecto panel boards guarantee dependable insulation, help designers save space. New 1955 Dilecto catalog is yours for the asking, lists all new grades.



C-D-F MOLDS MANY SPECIALTIES This shaft insulator for a circuit breaker is molded from C-D-F's cloth-based industrial thermosetting plastic, Celoron. Note complexity of mold, clean detailing. Celoron has high impact strength, is used in switchgear.

C-D-F GIVES YOU BETTER MOTOR AND GENERATOR INSULATION All these built-up and bonded mica products are made by C-D-F to provide uniform high-heat resistance and dielectric strength. All forms of Micabond are made for better performance and lower costs.



Built-in cooling system!

Boosts current-carrying capacity 20%

CHASE® VENTILATED SQUARE COPPER TUBE BUS CONDUCTOR!

Natural convection makes the big difference! As temperature rises in Chase ventilated square copper tube bus, cooling air circulates freely through the staggered holes in the tube. Temperatures and electrical resistance stay at a minimum because of this efficient heat dissipation. Excessive local heating, too, is prevented because Chase ventilated bus has rounded corners. And Chase square bus is beam-rigid—mechanically strong in all directions!

Write for *free* Chase Bus Conductor brochure *today!*

Chase®

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

Atlanta	Chicago	Denver	Indianapolis	Minneapolis	Philadelphia
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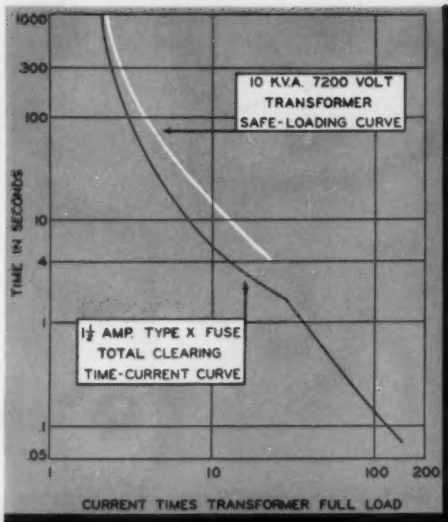
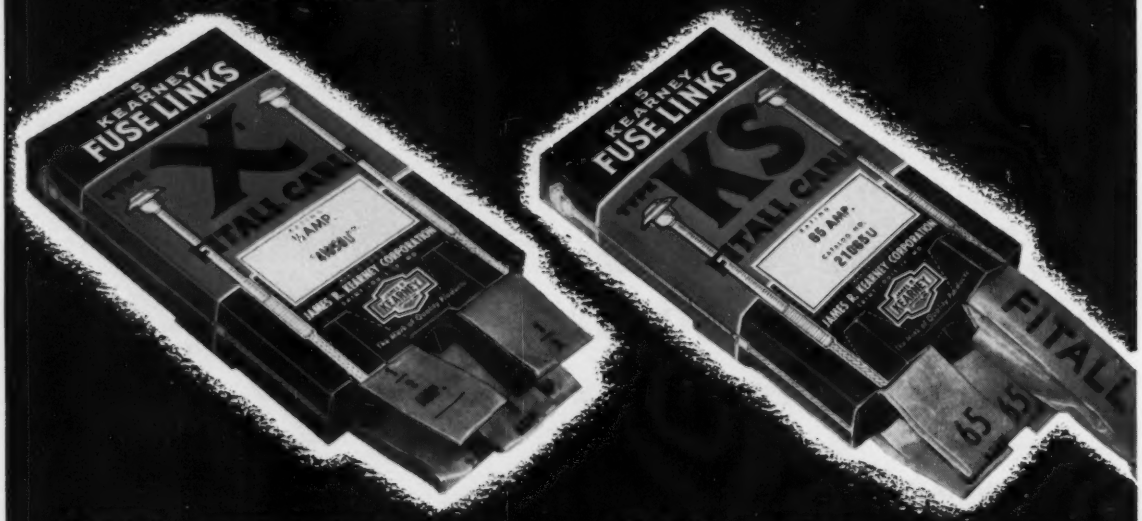
Boston	Cleveland	Grand Rapids	Los Angeles	New Orleans	Providence
Charlotte	Dallas	Houston	Milwaukee	New York	Rochester
	St. Louis	San Francisco	Seattle	Waterbury	



Coordination cuts down trouble calls...

when you use KEARNEY *Specialized* FUSE LINKS

Coordination protects two ways: guarding equipment against overload damage *and* protecting you from needless load dropping and revenue loss. The matched time-current characteristics of KEARNEY specialized fuse links make possible safe, accurate coordination.



TYPE "X" . . . specially developed to keep transformers in service during overloads and surges, yet always interrupting before the damage range is reached . . . opens 230% of rated load within five minutes.

TYPE KS . . . specially developed to protect and yet minimize outages on circuits subject to switching and lightning surges . . . carries overloads up to 150% indefinitely without damage to fuse or cutout.

JAMES R. KEARNEY CORPORATION • 4224-42 Clayton Ave., St. Louis 10, Mo. • *Canadian Plant:* Guelph, Ontario

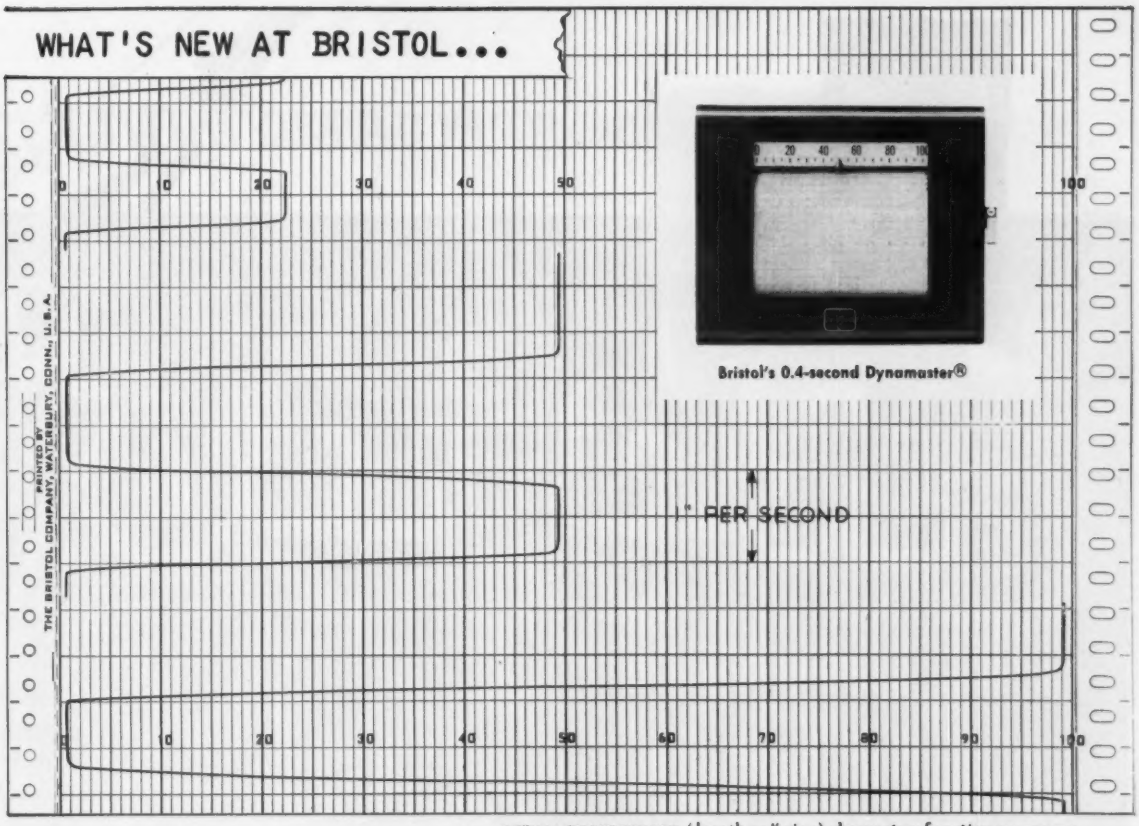
306

for BETTER CONSTRUCTION
SAFER MAINTENANCE
Specify

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. GUELPH, ONT.

The Mark of Quality

KEARNEY PRODUCTS



ACTUAL CHART RECORD (less than ½ size) shows step-function responses for various magnitudes. Chart speed: 2 divisions (1 inch) per second.

New Bristol High-speed Dynamaster® Recorder

crosses 11-inch chart in 0.4 second

SPECIFICATIONS

SPEED
0.4-second to within 0.25% of balance for full-scale step-response without overshoot.

SENSITIVITY
Dead band less than 0.1% of full scale.

RANGES
Minimum range of 1 millivolt d-c.

CHART
12¼ inches, 11 inches calibrated.

CHART SPEEDS
Up to 4 inches per second.

Bristol's new 0.4-second Dynamaster is the fastest self-balancing recorder on the market! And with no overshoot!

This high-speed instrument sets new standards for recorders in the fields of rocket and jet-engine testing, wind tunnel measurements, automatic-machine-tool control, scientific laboratory testing and numerous industrial applications.

What's more, no sacrifices have been made in the usual Bristol high standards in building this high-speed instrument. The accuracy, sensitivity, minimum range, reproducibility, dynamic characteristics and reliability of this new model are the same as for slower-speed Dynamasters. The instrument is equipped with a control to adjust the damping characteristics.

Write for complete data on this instrument today. The Bristol Company, 116 Bristol Road, Waterbury 20, Conn.

5.37

TRADE MARK BRISTOL'S REG. U.S. PAT. OFFICE

BRISTOL

POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

SPECIALLY BUILT

"Rhino"

LINE TRUCKS FOR 2-MAN CREWS!

This truck has a nose for work—work that conventional trucks can't really handle. The "Rhino" is specially built to take the rugged stress and strain from front-mounted derrick and digger with a live front axle rated at 9500 pounds—50% stronger than ordinary truck axles. The long, powerful front spring suspension is FWD-Engineered to take massive front end workloads.

2-MAN OPERATION
Saves Man-hours

The Rhino's front-mounted derrick and/or digger works out-front where the driver has a full view of the job being done. No need to jockey back and forth with extra men giving directions. Just drive into position where the No. 2 man guides the earth borer or swings the pole base into place. Two men do the work of five with better control, lower cost.

DIG MORE HOLES
Set More Poles... Travel Anywhere

The FWD "Rhino" does it all faster, cheaper! Load it down with equipment and move off to the job—fast and smoothly down the road, steadily and safely through the roughest off-highway terrain. You dig more holes, set more poles **anywhere** with the versatile and economical Four Wheel Drive "Rhino."

FWD MATH-MATIC DESIGN

Send for illustrated "Rhino" folder for your equipment file. There is an FWD Utility Specialist near you who can give you the "Rhino" working profit and safety story without obligation. Call collect for his name.

THE FOUR WHEEL DRIVE AUTO COMPANY

TO TAKE HEAVY FRONT-END LOADS

OUTPERFORMS CONVENTIONAL OR CONVERSION TRUCKS!

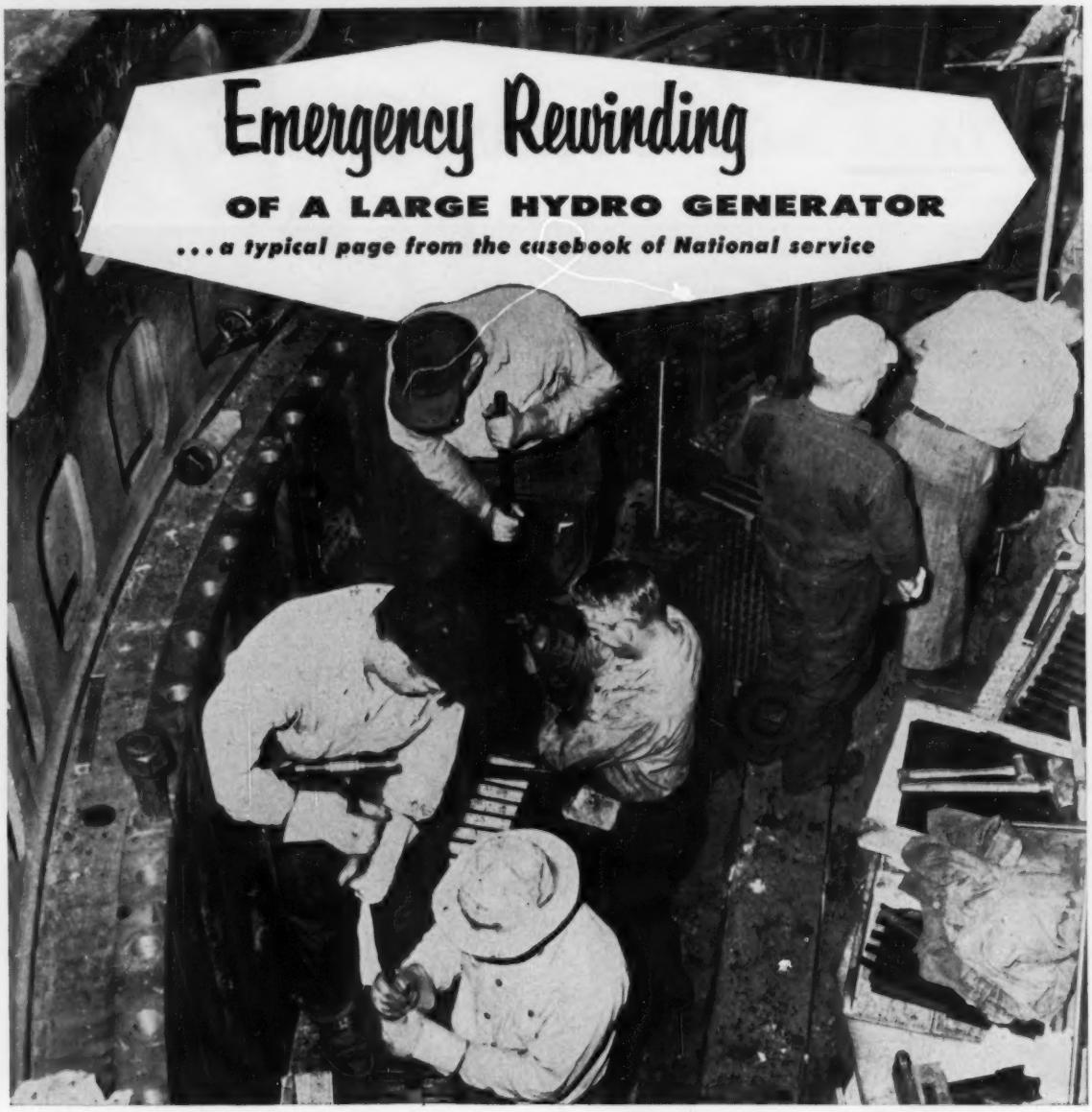
The FWD "Rhino" is the only line truck built *to take* front-end workloads . . . with the driving front axle built 50% stronger than ordinary axles, with the special front spring suspension, and FWD's special alloy steel frame which has a 250% greater bending moment than competitive trucks.

This new Four Wheel Drive unit fits any front-mounted derrick or digger, any approved line body . . . giving you a line truck tailored to your line service requirements.

The FWD "Rhino" is specially designed to fit the rugged demands of utility line work . . . to help you cut down-time and repair costs.

For working economy, get the truck that's built to do many utility jobs faster, cheaper. Let the FWD "Rhino" help keep electric service today's best buy.

CLINTONVILLE, WISCONSIN • *Canadian Factory,* KITCHENER, ONTARIO



When this 65,000 KVA waterwheel generator "blew up," National people worked around the clock until it was back in service. National field engineers supervised stripping of the machine, restacking of the iron and installation of the coils. By the time the core was ready, coils were flowing out of National's Columbus plant in twice-weekly partial shipments. More than 10,000 pounds of mica tape and 50,000 pounds of copper—fabricated by National's insulation department and wire mill—were used. The last of the 420 coils was completed six weeks after the job was started. Total down time on the generator was only nine weeks. And the rewound machine had a capacity of 74,750 KVA.

Unusual case? No, just a typical example of what National can do. That's why you should invite your nearby National field engineer to tell you all about National services—why you should think first of National when you have a problem with any large rotating electrical machine.

NATIONAL ELECTRIC COIL COMPANY

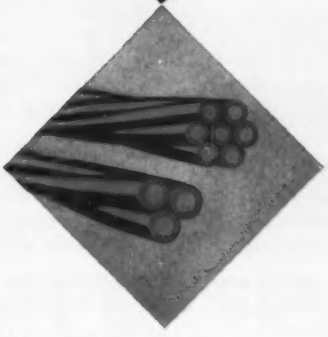
COLUMBUS 16, OHIO, U. S. A.

TRADE MARK

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

From the day they're installed...

and throughout the entire life of the line...



Copperweld Guys give safe, strong support at lowest cost per year!

The permanent high strength of Copperweld* Guy Strand means permanent support for your overhead lines year-in and year-out. Guy repairs and replacements are eliminated once and for all. There's no doubt about it—the few extra pennies you pay for Copperweld Strand buy many extra years of dependable guying service. Why not start using Copperweld now—and save on upkeep every year for the life of your lines.

*Trade Mark

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION
Glassport, Pa.
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

Copperweld
TRADE MARK
non-rusting GUY STRAND

***The Best** in Terms of Safety and Service!*

How a new coating...ALUDUR®... provides the answer to the corrosion problem in pole-line hardware

By James H. Foote, Vice President and Chief Engineer, Electrical Manufacturing Company

Technological advances during the past two or three decades have greatly increased the service life of most line construction materials. Unfortunately no similar substantial improvement in pole-line hardware has occurred. As a result hardware is now the limiting factor in the life of most lines. To make matters even worse, diversification of industry is introducing corrosion problems into many areas previously free of them.

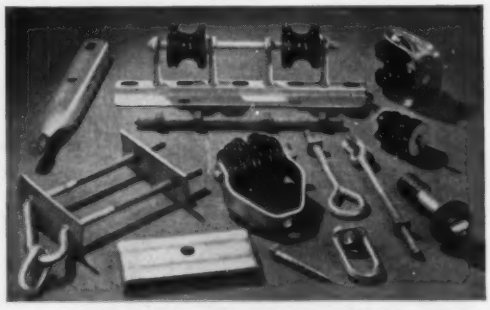
Over four years ago, here at Electrical Manufacturing Company, we began a search for a protective coating superior to zinc. Our studies resulted in the selection of aluminum for the coating material. A major factor in this decision was that ASTM outdoor corrosion tests* of over 20 years' duration indicated a marked superiority of aluminum, hot-dipped applied, over hot-dip galvanized steel. Extensive research led to the selection of a corrosion resistant alloy of aluminum that would properly alloy itself with steel to form the same strong, flexible bond obtained in good galvanizing. This bond is of the inter-metallic type similar to the iron-zinc bond of the hot-dip galvanizing process. The outer layer of aluminum has a thickness in the order of .003".

Here is an early pilot-scale Aludur line, showing the cleaning and pickling operation.

We have perfected a process by which the aluminum is applied and have named the resultant coating Aludur. Considerable research is still to be done, however, before full scale production can be realized. The much higher temperatures and the greatly reduced density of the molten aluminum have indicated the necessity of entirely different operating techniques than those used in galvanizing. A large portion of these techniques have been developed and our pilot plant is presently turning out a variety of products. Additional items will be available as more operating experience is gained.

Accelerated corrosion tests indicate that Aludur hardware will have a service life of at least three times that of the best hot-galvanized hardware. Outdoor long-time exposure tests are presently in progress in highly corrosive areas.

We are now in a position to produce limited quantities of many pole-line hardware items in Aludur. We feel that Aludur could solve many of your corrosion problems and of course invite your inquiries.



E-M products include bolts, anchor rods, braces, pins, pole-top fixtures, brackets, clevises, secondary racks—a complete line of pole-line hardware.

58

Tests under the jurisdiction of Subcommittee XVI of ASTM Committee A-5 on Corrosion of Iron and Steel

EM ELECTRICAL MANUFACTURING COMPANY • Battle Creek, Michigan

Designers and manufacturers of pole-line hardware that saves you time, money, and maintenance. Prompt action on special problems.

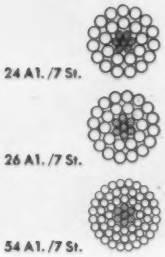
NO MORE POLE DECAY...
THEIR PERMANENCE IS LIKE A "HERITAGE"
LIFE-SPAN
WESTERN RED CEDAR POLES
Completely immunized from top to butt—the clean, odorless LIFE-SPAN Poles will give trouble-free line service to pole-line obsolescence.
When you're planning construction, specify the name LIFE-SPAN Western Red Cedar Poles. They're nature's best—perfected for posterity.
BUILT BY NATURE
Life Span

Write for complete information

PAGE & HILL, INC.

MINNEAPOLIS 3, MINNESOTA

ACSR Bird Cages Are "Kaputt"



Yes! "Bird-Caging" can be eliminated with Midland ACSR . . . for although it takes a bit longer to produce on our slower moving Planetary Stranders, we are able to produce a highly superior product with them! All the strands in Midland ACSR are laid into the cable evenly and are tension perfect. This includes our full range of ACSR sizes from AWG#6 to largest circular mill.

MIDLAND WIRE CORPORATION

MIDLAND WIRE CORPORATION

DIVISION OF ESSEX WIRE CORPORATION

Factories at Birmingham, Alabama; Anaheim, California; Tiffin, Ohio

VOLTAGE REGULATORS

PROFITABLE VOLTAGE REGULATION
to help solve your distribution problems

New General Electric Induction Voltage Regulators Save up to 32%

Here are the actual Net Prices*
125-KVA "RM" 2500/5000-Volts

$3894

Replaces these SEVEN units:

2500-Volts	5000-Volts
75-KVA $4072	62.5-KVA $3919
100-KVA $4870	75-KVA $4330
125-KVA $5537	100-KVA $5124
	125-KVA $5753

114.3-KVA "RM" 7620-Volts

$4092

Replaces these TWO units:

7620-volts
76.2-KVA $4194
114.3-KVA $5819

*Eastern Zone. Western Zone prices slightly higher. Manufacturer's suggested resale prices.

Two REPETITIVE MANUFACTURE sizes cover NINE former station ratings

COST SAVINGS of over 30% are now possible with new General Electric "RM" induction voltage regulators. Nine of the most popular ratings have been consolidated into two *standard* "RM" units, each of which costs less than any of the units it replaces!

MORE LOAD GROWTH CAPACITY, at less cost. Utilizing the benefits of high-volume Repetitive Manufacture, these regulators offer the same quality and design features as previous G-E induction units, plus new improvements.

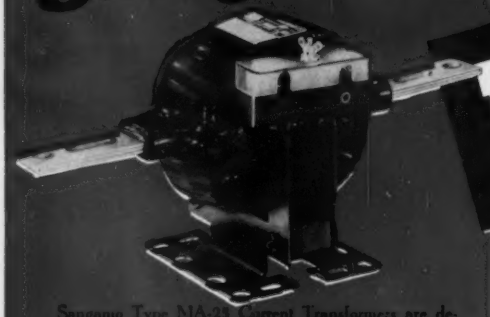
Get full information today on this new cost-saving answer to today's expanding loads. Contact your G-E Apparatus Sales representative, or write to Section 423-12, General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

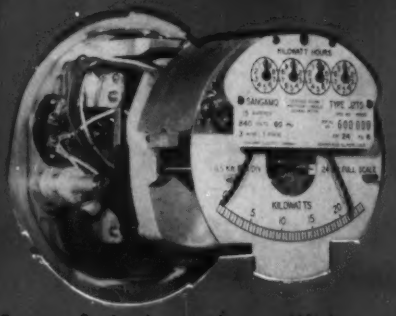
GENERAL ELECTRIC

SANGAMO

Safeguards Performance with NATVAR 400



Sangamo Type MA-25 Current Transformers are designed for indoor service on metering applications. They are wound type with single primary and single secondary, and meet A.S.A. 2.5 KV insulation class test requirements—15 KV at 60 cycles and 45 KV full wave impulse. Natvar 400 Extruded Vinyl Tape is used "because of high insulation value, resistance to heat and ability to form itself to the shape of parts being insulated."



Sangamo Single phase combination Watthour and Demand Meters like the Type J2TS illustrated are built and tested for sustained accuracy under varying temperatures, ease of calibration and repair, resistance to corrosive atmosphere, and ample capacity to measure heavy loads. Natvar 400 Extruded Vinyl Tubing is used for insulation because it meets the requirements with plenty to spare.

Sangamo is one of the most respected names in the electrical industry. For more than fifty years Sangamo meters have measured electricity with great accuracy, have required little maintenance, and have been easy to test and repair. Meters and associated equipment are made in the Sangamo Electric Company plant in Springfield, Illinois.

They safeguard performance through good design for each requirement, individual tests at various stages of manufacture, and careful selection of materials. Natvar 400 Extruded Vinyl Tubing and Tape are used because of their uniformly good electrical and physical properties—particularly the ability to resist heat, oil, corrosive atmosphere and abrasion.

All Natvar flexible insulations are uniformly dependable no matter where or when purchased. They are available either from your wholesalers' stock or direct from our own.

Natvar

Natvar Products

- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
- Varnished—Silicone coated Fiberglas
- Varnished papers—rope and kraft
- Slot cell combinations, Aboglas®
- Vinyl coated—varnished—lacquered tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

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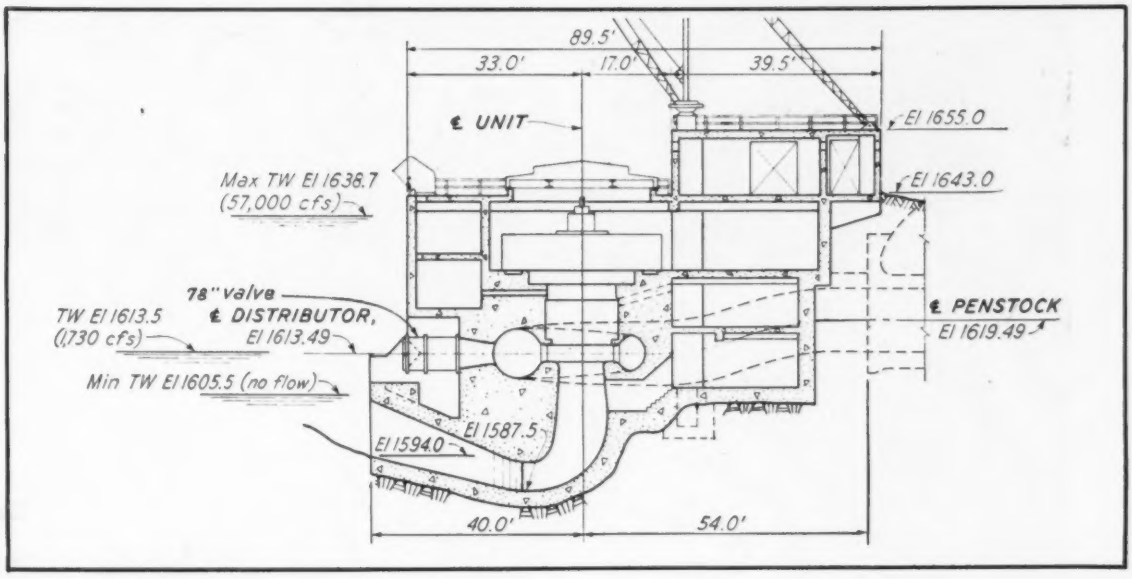
TVA Installs *Another* Leffel Turbine

Nottely Dam Power Plant — a progress report as of the end of 1955



Completely assembled turbine except for riveted scroll case.

Power house excavation and draft tube forms in place.

Assembled scroll case in position from above.

In the new hydroelectric power plant on the Nottely River near Murphy, North Carolina, the TVA is now completing the installation of another efficient Leffel turbine.

Nottely Dam, of the rock and rolled earth fill type, was completed in 1942, without a power unit. Installation of the No. 1 power unit was authorized in 1951 and a Leffel turbine was selected to drive the generator.

The turbine is rated to develop 21,000 HP under a net head of 124 feet at 180 RPM. The specific speed of the turbine at rating is 63.2 RPM. The operating head varies from 76 feet to 166 feet.

Other Leffel turbines installed by the Tennessee Valley Authority are located at Chatuge Dam in North Carolina and Wilbur Dam in Tennessee.

The efficient design and rugged construction of the Nottely unit—backed by 94 years' of experience in the hydraulic turbine field—make it typical of the notable hydraulic turbines built by Leffel for hydroelectric power projects throughout the world.

Leffel engineers are trained in design, construction and adaptation of the turbine which will most efficiently and economically meet the needs of each power plant development, whether it is a completely new installation or part of an expansion of rehabilitation program.

Before you plan your next turbine installation, be sure you have the complete story on rugged, efficient Leffel turbines. Write, wire or phone . . . you'll get action fast.

1094-E

FOUNDED IN 1862

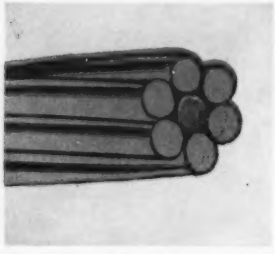
THE JAMES LEFFEL & CO.

DEPARTMENT P • SPRINGFIELD, OHIO, U. S. A.

MORE EFFICIENT HYDRAULIC POWER FOR 94 YEARS

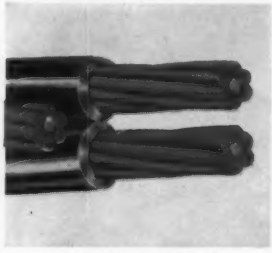
Planning to use more Aluminum Cable?

ANACONDA IS READY WITH THE BROADEST LINE IN THE INDUSTRY

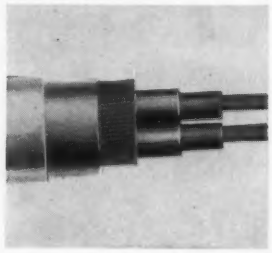


ACSR

Bare strand aluminum



Type N-SD



Silvaline*
Type SE service entrance

ASK THE MAN FROM

FOR

THE FACTS ARE PLAIN! No other company in the industry is prime producer and fabricator of *both copper and aluminum.* If you are considering aluminum, only Anaconda can give you the same fast service, quality products, cable experience and full-line choice in the white metal as you have had traditionally in copper. For Anaconda has:

1 *Broadest line of aluminum conductors in the industry* including bare aluminum and ACSR; Neoline*, Polene* and Duraline* line wire; Types SE, SD, N-SD and K service cables; aerial power cable; network cable; cathodic protection cable; and many others.

2 *Seven-mill service.* Anaconda has more mills producing aluminum wire and cable than any other manufacturer. Seven fabricating mills strategically located across the country assure speedy service.

3 *Electrical Distributors.* Anaconda Wire and Cable Company has several hundred electrical distributors located throughout the country who can expeditiously provide you with Anaconda products.

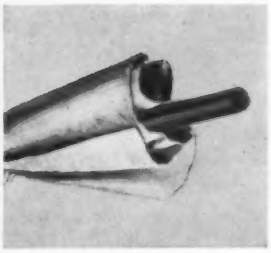
4 *Reduction plant* at Columbia Falls, Montana, gives Anaconda control over its aluminum production from reduction of alumina . . . to wirebar . . . to rod . . . to finished product.

5 *Insulated-cable experience* — in design, research, construction and quality control — helps Anaconda produce aluminum wire and cable with superior electrical and physical characteristics.

6 *Technical assistance.* Anaconda field engineers have worked in advisory capacity on hundreds of complex jobs. They are ready to put their experience and knowledge to work on your problem.

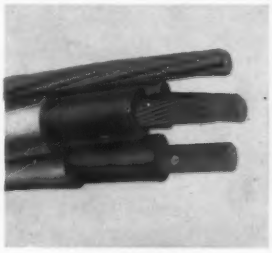
THE MAN FROM ANACONDA will be happy to help you. Backed by the broadest line of wire and cable in the industry in both copper and aluminum, he is best qualified to help you arrive at the most practical and economical answer to your cable needs. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

*Reg. U. S. Pat. Office



Duraline*

Neoline* and polyethylene line wire



Aerial cable

Type CP cathodic protection cable

ANACONDA®

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BUFFALO "BLH"
FOR CLASS 2 THRU 4 VENTILATING-INDUSTRIAL & MECHANICAL DRAFT SERVICE

THE NEW "Buffalo" Type "BLH" FAN is engineered for installations where total pressure requirements of 3¾" and up exist. These applications include mechanical draft, conduit air conditioning and many industrial applications.

CANTILEVERED INLET VANES eliminate center ring, reducing turbulence and improving air flow through the inlet. The die-formed inlet vanes and inlet bell further contribute to smooth air flow, minimizing effects of unfavorable inlet conditions.

THE PROVEN BL WHEEL has a deep drawn flange to form a true half-circle with the inlet cone. Highly efficient non-overloading backward-curved blades, solid back plate and extra heavy hub make this wheel ideally suited to this service.

IMPROVED FAN OUTLET — reduces outlet air turbulence from fan cutoff into duct by making more even, gradual change from velocity to static pressure. Without this complete streamlining of inlet, housing AND outlet, such high efficiency is impossible.

Smooth Divergent Flow

86% MECHANICAL EFFICIENCY — made possible by a combination of inlet, wheel and housing design. The smoothest "air-ride" in fan history.

"Buffalo" "Q" FACTOR* CONSTRUCTION gives you many years of trouble-free service. Housing is all-welded construction. Wheel and blades are riveted and welded for maximum strength, the basic design having been thoroughly tested in the Vacuum Pit, a "Buffalo" exclusive.

AVAILABLE in wheel diameters from 18¼" to 80¾", the new "Buffalo" "BLH" merits your consideration. Write for details on your company letterhead — today.

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

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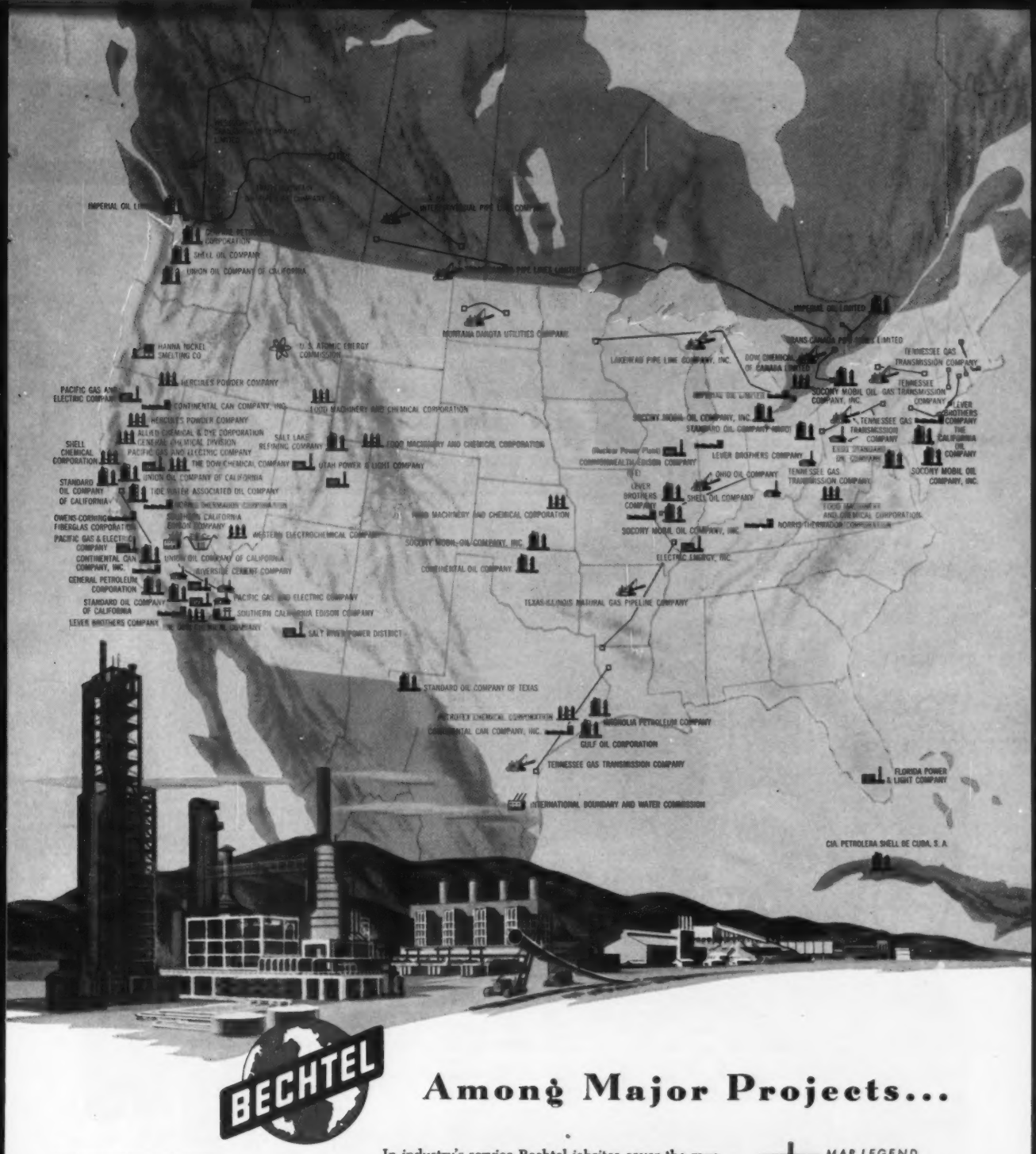
BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING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In industry's service Bechtel jobsites cover the map from British Columbia to Cuba. Other projects are located in Hawaii, South America, England, Italy, the Middle East, Korea and the Philippine Islands.

Engineering and construction experience accumulated in many parts of the world enables Bechtel to move into any area—foreign or domestic—and complete assignments with speed and economy. "Ahead of schedule, under budget" is an objective consistently met in practice.

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NEW 1956 CHEVROLET

WEIGHT CLASS! CHEVROLET

New Chevrolet trucks for '56 bring you new heavies, middleweights and lightweights in eight great new series—new power and performance to save more money on your hauling job!

New Heavyweights—New Tandems! All-new heavyweights in 9 wheelbases, with maximum G.V.W. ratings up to a new high of 32,000 lbs.; G.C.W. up to 50,000 lbs.

Ultra-Modern Features! Tubeless tires, standard; High-Level ventilation and panoramic visibility; plus Concealed Safety Steps on most models.

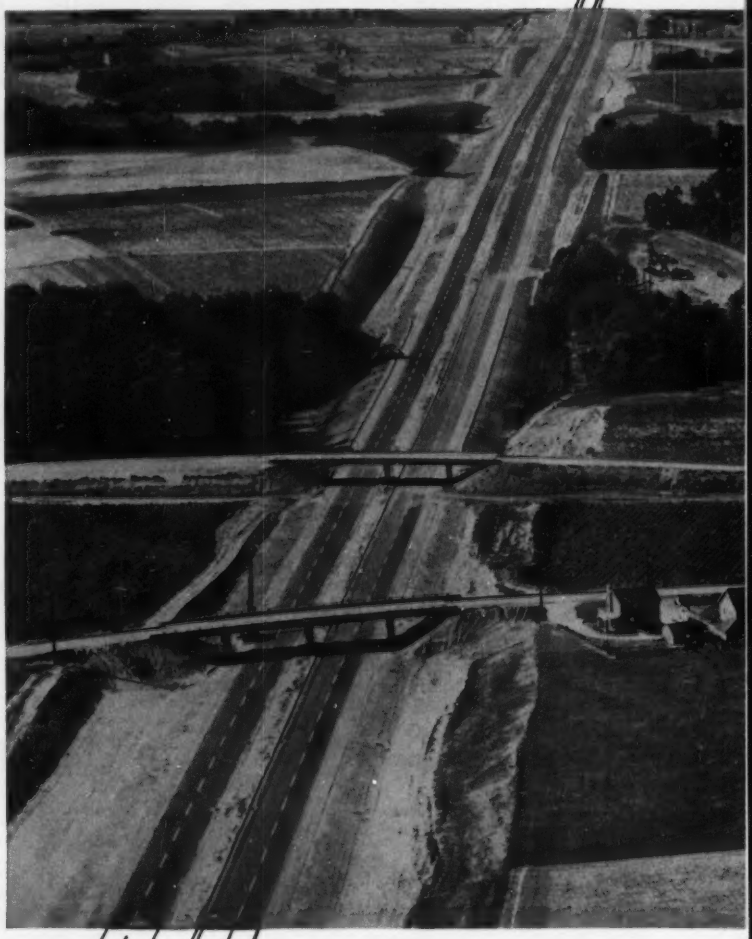
Wider Range of Drives! There's an automatic drive in every series with new Powermatic for most middleweights and heavies; Hydra-Matic for light-duty models. Both extra-cost options. A new 5-speed transmission is standard in 9000 and 10000 series models; optional at extra cost in other heavies and most medium-duty models. New heavy-duty 5-speed is an extra-cost option in models with new Loadmaster V8.

A Modern V8 for Every Model! And introducing the completely new 322-cu.-in. Loadmaster V8, standard in new 9000 and 10000 series heavyweight models.

See Your Chevrolet Dealer and his new Task-Force line before you buy. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

TASK·FORCE TRUCKS

Keeping the



...with RCA 2-Way Radio

RADIO CORPORATION
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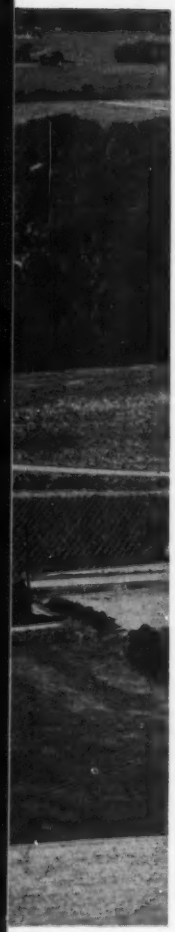
Turnpikes *on the beam* means Dependable RCA Microwave



Those high towers you see as you drive along the great turnpikes usually mean that RCA Microwave is on the job providing instant and continuous communication. On the Pennsylvania Turnpike, the New Jersey Turnpike, the Ohio Turnpike . . . wherever the ultimate in dependable communications is required, RCA's performance record, in applications pitted against the toughest service conditions, tells the story of fine performance. A narrow radio beam passing from tower to tower transmits the human voice and operates control circuits. It will carry voice circuits, facsimile, teletype, telemetering, traffic information—all without the weather hazard interruptions, maintenance costs and right-of-way problems of wire lines.

ON PIPELINES—In the petroleum and natural gas industries, where pipelines knife across the country, RCA Microwave Systems link control points and unattended remotely operated booster stations. Pipe line capacity is increased and operating costs are cut. VHF control channels allow immediate contact with maintenance personnel.

IN UTILITIES—In electric utilities, RCA Microwave provides remote supervisory control of substations, load control, and telemetering of voltage and current . . . with 2-way voice channels providing communications between plant and switching stations.

RCA MICROWAVE provides the most advanced engineering features. Provision for the addition of future channels makes it the least expensive form of communication per channel mile. Equipment uses easy-to-service, familiar circuits and readily available tubes. Single side-band suppressed-carrier frequency-division multiplex is used exclusively to meet high standards of dependability. Frequency throughout the entire system is controlled at the terminals only. And only two frequencies are usually required. Furthermore, RCA provides the nationwide services of the RCA Service Company to keep your system operating at its peak.

RCA Microwave Specialists with years of microwave experience will be glad to answer any questions and to assist in planning your installation. Mail coupon for further particulars.

RCA MICROWAVE can interconnect with mobile radio installations as well as with existing telephone lines and switchboards. Patrol and maintenance units can be immediately contacted while driving along the road, saving parking and back-tracking time and preventing costly delays.

RCA MICROWAVE

POINT-TO-POINT COMMUNICATION

Radio Corporation of America
Communications Products, Dept. CC-45
Building 15-1, Camden, N.J.

☐ Please send me latest literature on RCA Microwave.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

☐ Have RCA representative get in touch with me.

Why buy a truck in the dark?

"Oh, kick me!" cries Merchant Neal,
In a posture hardly genteel.
He bought trucks in haste,
Then the costly fact faced,
That he'd missed the Dodge Dealer's Deal!

If you buy a new truck after looking at only one make, it's like making a deal in the dark. A smarter way to buy is to "*spotlight*" *real truck* value—weigh and compare competitive claims with these Dodge truck facts:

Most standard V-8 horsepower of all leading makes—½-ton through 3½-ton range. You'll make faster trips—get more work done!

Shortest turning radius. You'll maneuver in traffic, and park more easily.

Biggest cabs, with biggest wrap-around windshield. You'll enjoy more comfort, safer vision.

Highest payload capacities . . . pick-ups providing up to 22% more payload than others.

Prices down with the lowest.

Next truck you buy, don't deal in the dark. Turn a bright light on the facts. See Dodge before you buy.

GET THE DODGE DEALER'S DEAL BEFORE YOU DECIDE

DODGE
Job-Rated
TRUCKS
WITH THE *FORWARD* LOOK

Shoot FOR ECONOMY AND TOP PERFORMANCE

Andersons' PISTOL GRIP

TYPE "PG" ALUMINUM DEAD END CLAMP

*** HIGH holding power!**
Ideal for long span distribution and sub-transmission.

A new quadrant type dead end clamp that more completely meets all the requirements for proper handling of aluminum and ASCR cable on distribution and sub-transmission systems!

- LIGHT WEIGHT . . . to reduce cable damage!
- HIGH STRENGTH . . . over and above ratings of cables and insulators normally used!
- ONE-PIECE KEEPER ASSEMBLY . . . for quicker, simpler installation!
- FLARED MOUTH . . . to reduce chafing and vibration damage!
- CORROSION RESISTANCE . . . silicon bearing #356 aluminum alloy.

3 SIZES FOR COMPLETE RANGE . . . recommended for all-aluminum and ACSR cable. No liners required.

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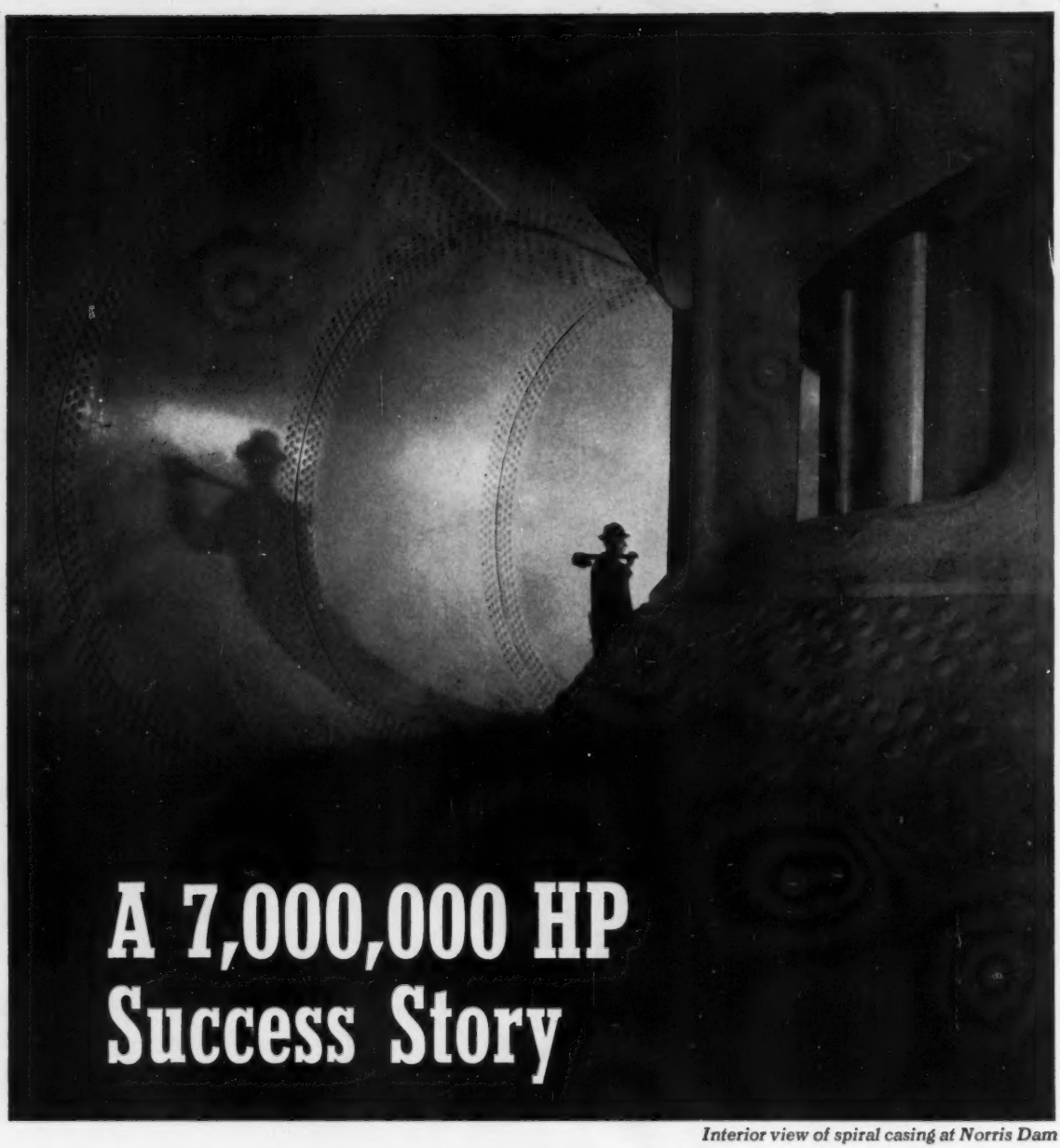

A 7,000,000 HP Success Story

Interior view of spiral casing at Norris Dam

Achievements of Newport News personnel in designing and building water power equipment during the past thirty years reflect a high integration of skill and production facilities.

Answering demands for hydraulic turbines rated as high as 165,000 horsepower and as low as 500 horsepower, this trained organization has successfully filled contracts with an aggregate rated output in excess of 7,000,000 horsepower.

Other essential equipment including penstocks, spiral casings, valves, pumps, gates and rack rakes are also designed and built by Newport News.

An illustrated copy of our booklet entitled, "WATER POWER EQUIPMENT," will be sent to you upon request.

NEWPORT NEWS **SHIPBUILDING AND DRY DOCK COMPANY**
Newport News, Virginia

Bulletin LTC 2906-156

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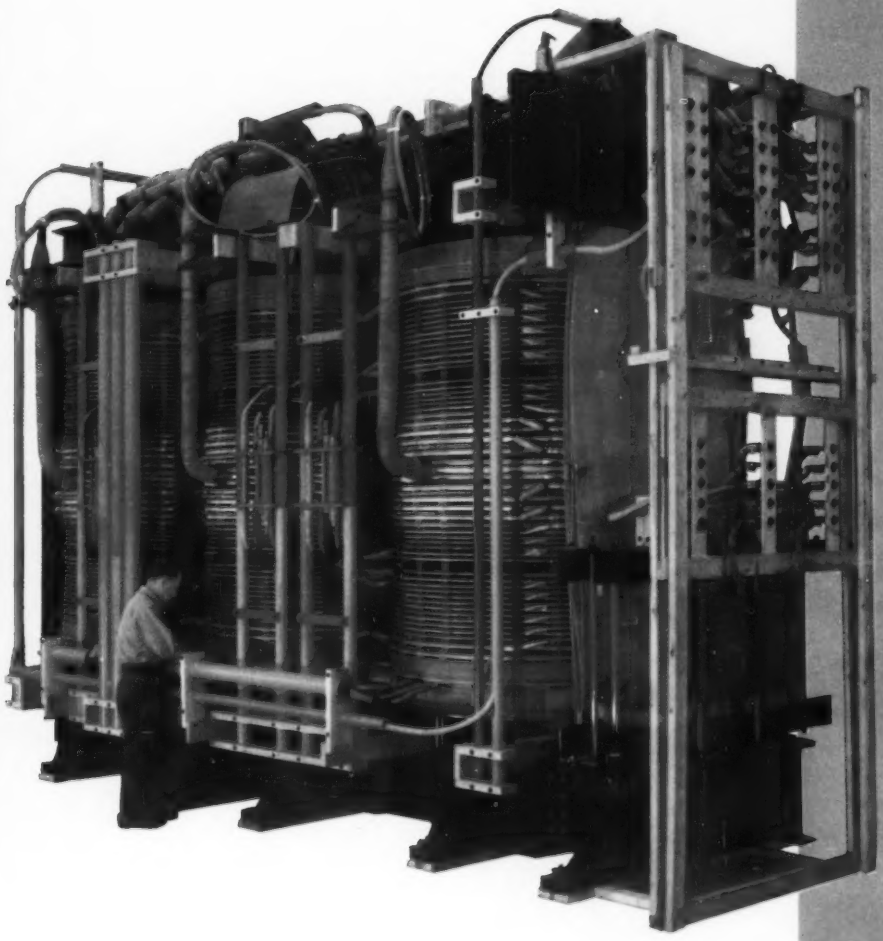
LOAD TAP CHANGERS

FOR DEPENDABLE VOLTAGE CONTROL



With dependable voltage control provided by Moloney LTC Transformers your utility can meet consumers' power demands at times when demands for power are profitable. Moloney LTC Transformers . . . available in any Kva and voltage rating . . . are extremely flexible and are adaptable to special applications. Whatever your system requirements, Moloney LTC Transformers add efficiency and dependability to your service.

For the reasons why Moloney LTC Transformers are your best buy see the next page.

MOLONEY ELECTRIC COMPANY

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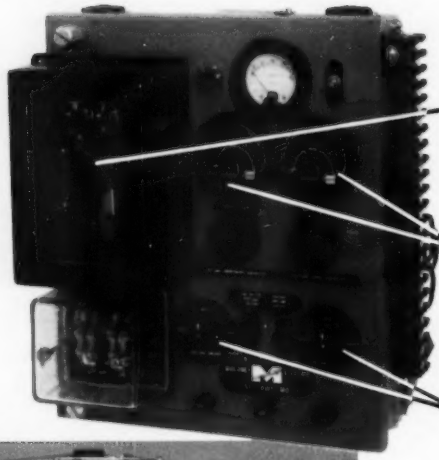


CONTROL SYSTEMS

for Moloney Load Tap Changers assure accurate voltage regulation because the contact-making voltmeter is sensitive to all line voltage variations. Energized compounding coils eliminate contact bounce, preventing unnecessary wear of relay contacts.

Motor driven synchronous timers delay tap changes from 0 to 120 seconds, preventing unnecessary tap changes for insignificant short duration line voltage fluctuations.

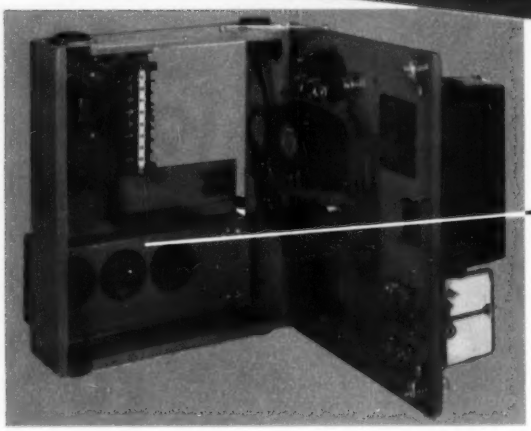
Current trip circuit breakers protect control wiring against overloads and short circuits.

Manual operation, for inspection and test, is provided by manual-automatic control selector switches.

Wiring is oil, heat and abrasion resistant and quickly accessible.

Shock-proof mounts prevent vibrations from disturbing control equipment.

The line drop compensator simulates load voltage drops between the transmission point and the load voltage center, and is easily adjusted through a wide range.



DRIVE MECHANISM

powered by a sturdy gear motor, operates at 80% of its rated voltage . . . assuring normal operation during severe dips in supply voltage. Gears are permanently lubricated when installed. Bearings require no lubrication because they're made from oil-impregnated bronze.

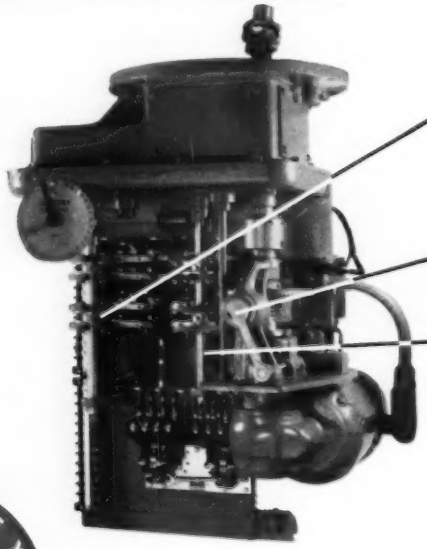
Limit switches, coupled to drive shaft, prevent drive motor from operating beyond the limits of switch mechanism.

Hand crank operation permits easy inspection and fast emergency operation of switch mechanism.

Mechanical and electrical interlocks prevent operation of drive motor while hand crank is in use.

Multi-purpose cams for special control operations can be added to existing units without revision or added machining.

Stuffing box permanently seals drive shaft entrance in switch mechanism compartment.



MOLONEY ELECTRIC

M O L O N E Y L O A D T A P

As Applied To: LOAD TAP CHANGING TRANSFORMERS • STEP VOLTAGE

TRANSMISSION ASSEMBLY

definitely times the drives to the load transfer and tap selector switch. Geneva gears throughout provide sharply accelerated movement for all switches.

Lightly stressed accelerating springs, in conjunction with the geneva gears, provide Moloney's patented "quick-make, quick-break" action for the load transfer switch. Through patented mechanical interlocking, the benefits from acceleration without loss of solid mechanical drive is assured.

Reversing switch geneva cam, controlled by the tap selector switch geneva gear, functions only when the tap selector switch is passing to a neutral position.

Mechanical stops prevent overtravel of all parts of the tap changing mechanism.

LOAD TRANSFER SWITCH

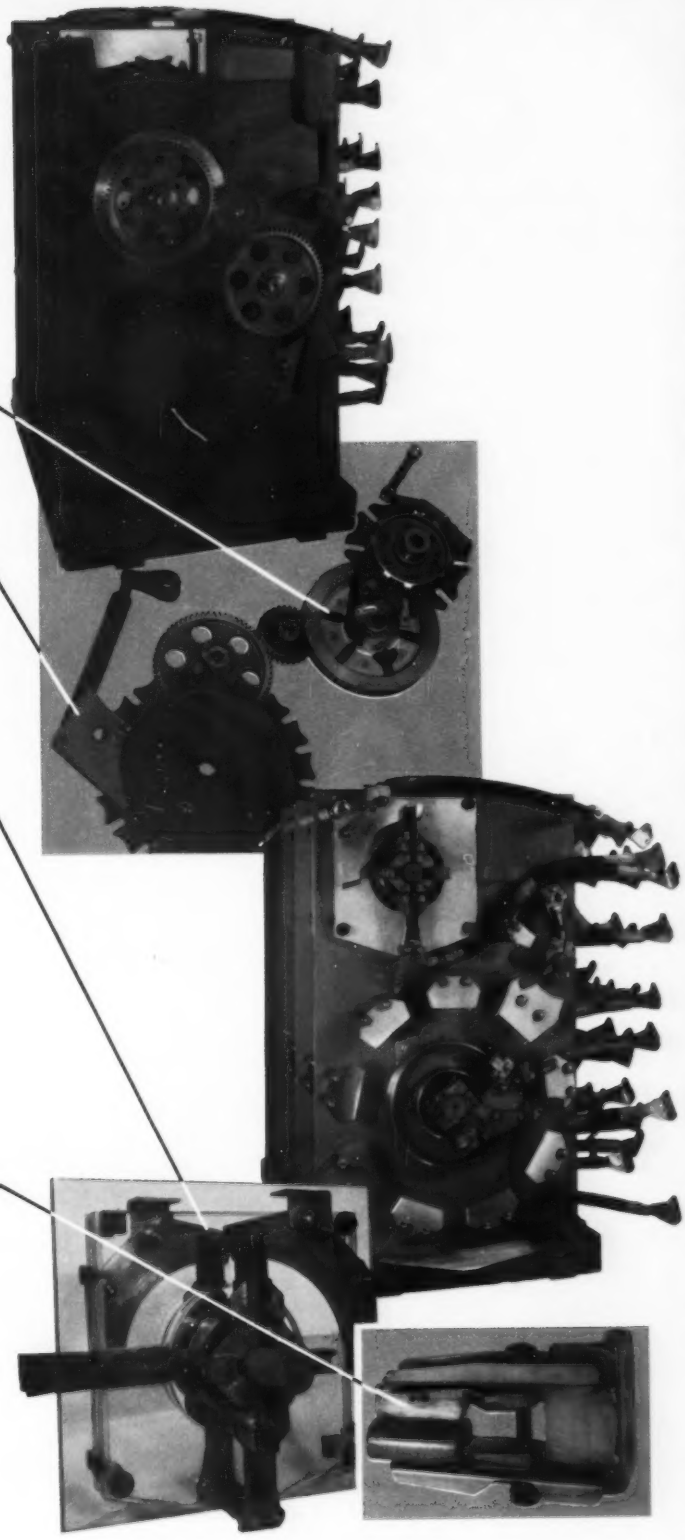
is the only current interrupting switch of the switch mechanism, eliminating all arcing at the tap selector switch. Arcing and arc gases are confined to load transfer switch area by a melamine enclosure, forcing gases toward the oil's surface.

Switches are mounted on thick, oil resistant bakelite panels, assuring ample mechanical and dielectric strength. Moving switch parts are clamped to heavy bakelite tubes and aligned by machined keyways.

Replaceable contact tips, on the load transfer switch, perform all current interrupting duty, and are made of a copper-tungsten alloy that resists arc erosion. Oil vanes, on moving contacts, quickly disperse hot oil, quenching arc.

Flexible, heavy gauge, stranded copper cables have liberal current carrying capacity and are protected by ample insulation.

Switch mechanism operates continuously and safely at full load at any point in its operating cycle.



Moloney engineering and design features have made Moloney Load Tap Changers an extremely flexible, self contained unit that is readily adapted to special applications. Consult Moloney engineers for information concerning unusual operating requirements or installations for your utility.

LITHO IN U.S.A.

Load Tap Changing Transformer—
125,000 Kva, three phase, 138 Kv, 60 cycle, FOA.

Specify Moloney . . . Get Dependability at its Best . . . All Along the Line

MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Load Tap Changing Transformers • Regulating Transformers • Step Voltage Regulators • Primary Unit Substations • Secondary Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers • Subway Transformers Industrial Dry Type Transformers • Capacitors • Magnetic Components For Electronics

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FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

EDITORIALS

All-Electric Home—A Sales Opportunity

The all-electric home offers the electric utility industry an unparalleled sales opportunity in the residential field. Studies presented in our special report (p 125) on the characteristics of the electric home load indicate a monthly use potential of 3,000 kwhr or more per customer.

A number of utilities are already seizing on this opportunity, concentrating their residential sales effort on the all-electric home. In southern California and in other areas new housing developments incorporate the major elements of the all-electric home. In the Tennessee Valley, the all-electric home is not uncommon. One utility in the Middle Atlantic states is competing with another in the Ohio Valley in the sale of heat pumps.

Despite this activity, there are today fewer than 305,000 homes which could be classed "all-electric." Many of these do not have electric cooling. As the report points out, the original cost and operation of an all-electric home is less than that of a low-priced automobile. Yet some 4.5 million American families own not one, but two or more automobiles. There is no doubt that the financial means exist to support a tremendous increase in all-electric homes if the desire for them can be kindled.

Of course, there is still considerable load research to be done before the industry has anything approaching a definite concept of its impact on system design. The present report is a contribution, but it also serves to point up some of the areas where more information is needed.

However, utilities now promoting the all-electric home are confident that its potential far outweighs the risks involved. They recognize that some components of this load offer opportunities for improving the annual load factor. And they have faith that the all-electric home raises no problems that cannot be solved by a resourceful management.

We share that faith. We are proud to dedicate this report on the characteristics of the all-electric home load to the Edison Electric Institute Sales Conference which convenes, March 26, at Chicago.

Never Underestimate the Power . . .

Until the other day we were delightfully ignorant of the fact that a kilowatt-hour had much of any weight at all, to speak of. We couldn't have been more wrong.

Out at Kansas City Power & Light Co our friend B. J. George uncovered the fact that one of these handy 3¢ items weighs every bit of 4×10^{-7} lb.

Now we appreciate what Mr George has done. But this is a disturbing bit of information. And it's been pestering us off and on for a couple of days. In fact ever since we did a simple division—it took 10 minutes to place the decimal point—and found that if sold by weight, kilowatt hours would cost \$75,000 a lb ($\$7.5 \times 10^4$).

What would the women of America say who have been kicking down the house over coffee priced at \$1 a pound? What, in fact, would our own wife say? So we asked her. "Would you be willing to pay \$75,000 for a pound of kilowatt-hours?"

We should have known better. We got another question! "How many in a pound?" she wanted to know right away. Five minutes and six decimal places later we had the answer: "2,500,000."

"How silly can you get," she said. "Why should we buy that many at once when that nice power company you are always talking about brings us all we need, one at a time. And besides, they don't sell them that way in the first place."

No "All-Time Records," Please

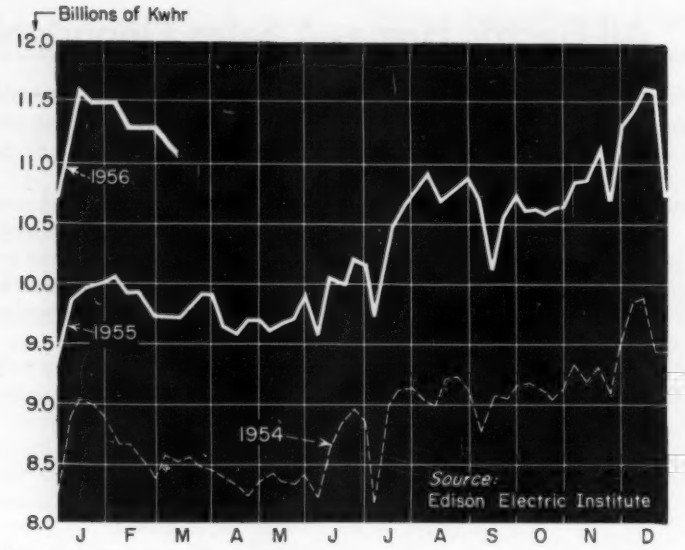
This is the discouraging season of the year. It is the time that we receive so many releases and annual reports telling about "all-time" (all time or alltime) highs in peak loads, generation, sales, net income, etc.

Electrical World editors have the greatest confidence in the growth and progress of the electric industry. So we do not believe any power supplier in the nation has reached its all-time high in any of the classifications mentioned. If we are right, the companies are wrong. They are wrong in the sense that they are using a word not included in the better dictionaries.

It would be more accurate if they said "record high" and would join us in our faith that the all-time highs are many years away.

ELECTRICAL WEEK

LAST MINUTE



OUTPUT

Week ended Mar. 10
11,133,000,000 Kwhr
Up 14.5%

Atomic Energy Commission requirements — 1,125,000,000 kwhr (Electrical World estimate). Excluding AEC output increase was 10.5%

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Mar. 10	+14.5	+11.9	+8.6	+23.1	+9.1	+11.9	+12.1	+10.8	+18.2	+14.2
Mar. 3	+15.1	+10.2	+8.9	+22.7	+7.6	+17.5	+10.7	+10.1	+17.2	+11.8
Feb. 25	+16.0	+11.7	+10.2	+25.0	+7.6	+14.5	+13.7	+7.5	+21.1	+15.2

Seasonally Adjusted Index 213.2 Week Ago 214.0 Year Ago 185.8

Issue's Highlights—Interior Secretary Douglas McKay to seek U. S. Senate seat in opposition to Sen Wayne Morse (D-Ore.) . . . Early vote on Niagara issue pushed by backers of state development of project . . . AEC reports on lignite beds as source of uranium . . . Congress seen authorizing bond issue to make TVA self-supporting.

Draper to Retire—Federal Power Commissioner Claude L. Draper will retire when his present term expires June 22. Draper, appointed by former president Herbert Hoover in 1930, has served continuously since then under Presidents Roosevelt, Truman, and Eisenhower. He is a Republican.

British A-Power—Sir John Cockcroft, director of Britain's atomic research establishment at Harwell, predicts Britain's future atomic power stations may have 500 Mw capacity each. This compares with 100 and 150 Mw for nuclear power plants scheduled, and 60 Mw output for the experimental Calder Hall power plant.

Friendship Pact—Washington WP and Big Bend Electric Co-op have signed friendship treaty for joint service of the Othello area in the Columbia Basin. Two have partitioned off area into service areas satisfactory to each and will exchange requests for service by potential customers. Firm with closest line will serve the new customers.

Westinghouse Outlook Improves—There were strong indications that strike-ending contract would emerge last week from renewed management-union negotiating sessions in Washington. Reports indicated that IUE was showing more willingness to settle its strike against company than it has for past several weeks. This was attributed to growing public opinion pressure on IUE, particularly since union's demand for clarification of federal mediation offer the previous week.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Washington Wire—Nation's consumers are optimistic about economy for next 12 months, according to FRB's 1956 survey of consumer finances released last week. Almost as many consumers intend to make home improvements as did last year; 9.6% intend to buy homes (it was 9.4% last year), and 28% plan major appliance purchases, down only .5% from 1955.

SEC and Commerce Department report on capital spending plans for industry in 1956 shows that public utilities, including electric companies, expect to increase capital plant by 16% over 1955. Electric machinery and equipment companies expect to spend $579 million compared with $436 million in 1955.

Rate Matters—Indiana PSC has granted Public Service of Indiana $3.6 million a year rate increase . . . Columbus & Southern Ohio Electric is asking Ohio PUC for $145,800 a year rate increase from rural customers in several counties . . . Arkansas PSC has denied Arkansas P&L's application for $5 million a year rate increase. AP&L's Pres R. E. Ritchie says company will appeal, "in order to preserve our financial integrity."

Priest Rapids Bids—Merritt-Chapman & Scott apparently has submitted low bid of $91.9 million for construction of Priest Rapids Dam on Columbia River. Receipt of bids enables Grant County PUD to negotiate power contracts.

Atomic Insurance—Columbia University study group, sponsored by Atomic Industrial Forum, has urged federal government should aid private insurance companies in providing coverage for unlikely but possible atomic disaster.

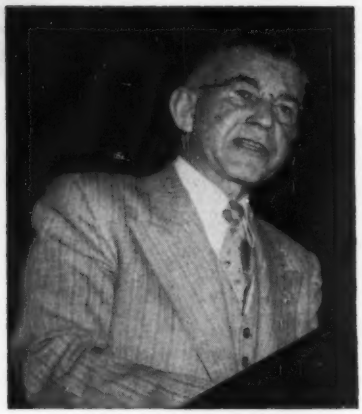
SEE Annual Conference—Walker L. Cisler, president, Detroit Edison last week told Southeastern Electric Exchange annual conference in Boca Raton, Fla., competitive nuclear power should be possible in ten years, or sooner. But, he added, "Nothing would be gained by crash program of building reactors which would contribute only slightly to the fund of nuclear knowledge" . . . W. J. Clapp, president, Florida Power, noted that companies comprising SEE are preparing for half million customer gain this year. Since 1940 customers have increased 155% and revenues 323%, he added. (For additional comments, see below).

ABOUT PEOPLE IN THE INDUSTRY

Advocates of socialization of the power industry have insinuated themselves to some extent into both major political parties, EEI Pres Harllee Branch, Jr, told SEE. "Hence the threat of governmental encroachment continues for our industry regardless of which party is in power. An understanding of this fact is important if our industry is to remain ever alert and not get caught with its 'guard down'," said Branch.

Utilities have problem in pricing service for both cooling and heating loads, Edwin Vennard, EEI vice president, told SEE. "Let us make the rate salable and let us design it so it will not hurt public relations. Let us avoid giving a penalty for poor load factor. Rather, let us give a discount for good load factor. Let us design the schedule so that customer's rate is not increased when demand meter is installed."

More News About People page 236



Power Battle Coming Up:

Douglas McKay

Versus

Wayne Morse

McKay to Resign, Run for Senate

- **Interior Secretary will resign cabinet post to enter Oregon's race for U.S. Senate; chief opponent will be Sen Wayne Morse, public power advocate**
- **Eisenhower endorses McKay who must defend Administration's power policies; Colorado's Dan Thornton being mentioned as possible next Interior head**

The Eisenhower Administration has moved to meet head-on the constant Democratic criticism of its electric power policies.

That is the meaning of the recent announcement that Interior Secretary Douglas McKay will leave the cabinet to run for the U.S. Senate in Oregon.

The move guarantees that far western state a raucous political season for it seems inconceivable that, after party primaries are finished in May, the senatorial combatants will be other than McKay for the Republicans and the incumbent Sen Wayne Morse for the Democrats. Thus, on the one hand, campaign platforms will hold the architect of the Administration power policy, and on the other, the man who is its foremost and steadiest critic.

Power Will Dominate Campaign

Probably nowhere but in Oregon and Tennessee is power such an issue that it could dominate an election in 1956. Certainly, the Republicans would put down Morse's name if they were given but one single Democratic senator they want to defeat.

Beyond that, the Oregon situation is fascinating because Morse was elected to the Senate in 1944 and 1950 as a Republican. He broke ranks in 1952 because he was "completely disillusioned" with Presidential Candidate Eisenhower during the campaign. Morse voted for Adlai E. Stevenson, sat for a time as the Senate's lone independent, and eventually began listing himself as a Democrat.

Bare Knuckles, Bruises Ahead

McKay and Morse probably will wage a bare knuckle campaign in which both will be bruised. For a sample of what will come in bigger doses one can look back over the record in recent weeks. There is Morse condemning McKay as the "worst Interior Secretary since Albert Bacon Fall" of Teapot Dome disgrace. And then there's McKay belaboring Morse as a "political turncoat" and one "whose political integrity cannot be relied upon."

McKay, who will be 63 next June, is possibly the President's personal choice to make the run against Morse. Washington hears apparently authoritative reports that Eisenhower used his considerable personal persuasive powers upon Mrs McKay and McKay —in about that order—to get his man into the race.

McKay says that Presidential Assistant Sherman Adams and Republican National Chairman Leonard Hall, but not Eisenhower, asked him to become a candidate.

In any event, Eisenhower had a "Dear Doug" letter of endorsement ready for release through the White House simultaneously with McKay's filing at Salem, Ore. This was considered especially noteworthy because it violated the President's policy of never endorsing a candidate before he has won nomination in a primary election.

McKay is the 35th man in the department's 107-year history to occupy the Secretary's chair. He is a veteran of Oregon politics, having served successively as mayor of Salem, a state senator, and governor before coming to Washington when the Eisenhower Administration took over in Jan., 1953.

Republicans Dour in '54

The record indicates he will need all his political skills in taking on Morse who claims one fall already over McKay and the Eisenhower Administration. That occurred in the 1954 Senatorial campaign when Richard L. Neuberger, a Democrat, unseated Republican Sen Guy Gordon in a 335,127- to-262,013 upset.

For Morse, it was all the sweeter because Neuberger was the first

Democratic senator to come from Oregon in 40 years. McKay, as the symbol of the Administration's power and water policies, was dragged into the campaign and given the full treatment by Morse and Neuberger. Gordon, although he did not make a strong campaign, tried to defend the Administration, McKay, and himself. There are many experts who figure his stand on Administration power issues harmed him less than did his farm record.

McKay probably will get more aid from Eisenhower than Gordon received. It is reasonable, many Washington observers feel, to expect that Eisenhower will make one or more Oregon appearances to help along the McKay cause. The Republican national organization certainly will come through with plenty of financial and other aid.

New Secretary May Be Thornton

The customary guessing about filling the vacancy in the cabinet has been slow warming up, mainly because it is not yet certain when McKay will be leaving.

However, the name of Gov Dan Thornton of Colorado, an Eisenhower golf-bridge-fishing companion, cropped up instantly as one favorite.

Others are mentioned, but none with any purported degree of authority up to now. Among them are Gordon, the ex-senator from Oregon, and Clarence Davis, now McKay's undersecretary and one of the brains behind the Administration's partnership power policies.

There's little reason in the present Washington atmosphere to believe that there will be any abrupt or important shift in national power policy so long as the Eisenhower Administration stays in control—no matter what the new Interior Secretary's name may be.

McKay Will Stand on Record

Morse's strategy, the outline of which is already clear, will be to attempt to keep McKay off balance—on the defensive. One thing is certain, McKay will be compelled—because of the very nature of political combat—to defend his record of more than three years in the Interior Department.

They have been busy, active years—fruitful from the Republican viewpoint, frustrating from the Democratic vantage.

For instance, McKay withdrew Interior Department opposition to development of the middle Snake River by a private firm, Idaho Power Co. This apparently scuttled for all time public power dreams for a federal high dam at Hells Canyon although Morse is trying to secure legislation that would revoke the Federal Power Commission licenses granted to Idaho Power to build a series of three low dams on the Snake.

Perhaps better than anything else, the Hells Canyon dispute illustrates the irreconciliable differences between the two Oregon antagonists.

Further, McKay was Eisenhower's chief adviser on the original partnership approach to development of power features in multi-purpose federal water resources projects. This involved U.S. financing for flood control, irrigation, and navigational features and private financing and ownership of power facilities.

Morse and other public power advocates didn't like that, nor did they like the new "softer" partnership approach McKay has endorsed for the John Day Dam on the Columbia River at the Washington-Oregon border. Under the new concept, four Northwest power companies seek to advance $273 million of the $312-million total cost in return for a 50-year contract giving them the power output. The government would build, own, and operate the generating plant; the private utilities would pay construction costs and an annual operation fee.

Even when the Administration puts its weight behind federal development, as in the recent $735-million Upper Colorado Project, McKay-Eisenhower critics let themselves go. The Administration policy, they say, is to give private industry the prime locations, such as Hells Canyon, and let the taxpayer bear the cost of developing the marginal ones. Their argument is that Upper Colorado power features will cost 74% more than Hells Canyon and generate 30% less power.

Edwin Vennard Steps in for EEI Duty

Edwin Vennard steps into his new post as a vice president of Edison Electric Institute. He is welcomed aboard by Col Howard S. Bennion, right, vice president and managing director of EEI, and A. B. Morgan, the institute's assistant managing director and secretary.

Formerly president of Middle West Service Co, Chicago, Ill., Vennard has been selected by EEI's board of directors to succeed Col Bennion, who retires July 1, as managing director (EW, Dec. 26, 1955, p 52). The new vice president brings with him more than 30 years of utility experience and trade association alliances. Vennard was chairman of the Commercial Division of EEI from 1942 to 1944, of Modern Kitchen Bureau in 1942, and of Sales Executives' Conference in 1950.

Vote on Niagara Pressed

. . . in Congress by backers of State Authority development as provided in Lehman Bill previously approved by Senate Public Works Committee with minority favoring private companies

Supporters of legislation authorizing the Power Authority of the State of New York to build the 1,620,000-kw, $405-million Niagara redevelopment power project are pressing Senate leaders for early debate on the measure. They have hopes, based on majority leader Sen Lyndon Johnson's (D-Tex.) promise of early consideration, of getting it scheduled soon after debate on the farm bill has been completed.

The Senate Public Works Committee approved the Lehman bill in January. The committee's report, delayed because of late submission of the minority views of five senators, was issued last week.

Bill Provides State Development

The legislation would direct the Federal Power Commission to license the New York State authority to build and operate the project, using revenues from power authority bond sales, and applying federal preference laws to marketing of the estimated 9.1-billion kwhr annual energy output. The committee directed that attempts be made to lease or buy existing transmission lines before building new ones to distribute the power.

Minority Wants Private Project

Four of the five dissenting committee members in their minority report advocated passage of the Capehart bill (S6), to authorize private utilities to develop the river's power potential. The committee has rejected this bill. The four who signed the minority report are Sens Edward Martin (R-Pa.), Norris Cotton (R-N. H.), Prescott Bush (R-Conn.), and Strom Thurmond (D-S. C.). The fifth, Sen Roman Hruska (R-Neb.), urged that a New York State referendum vote decide the issue.

The minority argued that the project is not a multi-purpose project and that the Lehman bill would, for the first time in the history of electric power development in this country, authorize by federal legislation public development of a project designed for power production only.

That report also points out:

• Private enterprise pioneered Niagara power development. Since the current plan is not a new project, but actually an addition to hydro developments dating back to 1895, the policy of Congress authorizing expansion of public power development where the government built the original facilities does not apply.

State Called Inexperienced

• The New York State Power Authority is completely inexperienced in the power business. It has never constructed or operated such a facility. On the other hand, the private upstate New York utilities have been developing power at Niagara for 60 years. If the state is licensed, it cannot produce power until 1958.

• Cost of Niagara power under state authority development would be low but "only because the rest of the citizens of the nation and of New York State pay the differential."

If the Lehman bill's supporters succeed in pushing the measure through the Senate, Congress will be faced with a real problem. The House has already voted favorably on the Dondero bill to authorize private development of the project. The conference between the House and Senate committees to reconcile the differences could cause a deadlock unless New York State Republican Congressmen change their minds and bow to public development. Former Gov Thomas E. Dewey favored New York State development when he was still in office, as does Democratic Gov Averell Harriman.

Decision by FPC Favored

The Eisenhower Administration is on record as favoring legislation authorizing the FPC to issue a license, without any directive from Congress as to who should receive it. This view was expressed in a Budget Bureau letter submitted to the 83rd Congress supporting a contemporary bill by Sen Francis Case (R-S. D.). The Case bill was not revived during the 84th Congress, but the administration has never indicated a change in its stand.

CEI's Lindseth Launches New Avon Plant Addition

Elmer Lindseth (above), Cleveland Electric Illuminating Co president, digs in to toss the first spade of dirt in recent ground-breaking for a $38-million, 250,000-kw Avon Power Plant addition.

The new turbogenerator represents the company's gamble on Cleveland's industrial future, Lindseth said. "By the end of 1958," he predicted, "there will be 50,000 more people gainfully employed in this area than there are today."

The new generating facilities, scheduled for operation at the close of 1958, will raise Avon capacity to 670,000 kw. The plant is located 20 miles west of downtown Cleveland.

Boiler for the unit will pass the steam generation "sonic barrier," the point at which water and steam acquire identical physical characteristics. It will generate steam at 3,500 lbs per sq in., reportedly a higher generating pressure than any in use in the world today. Smoke abatement and dust control apparatus will cost $1 million.

TVA Future Being Molded

. . . as House unit okays agency's plan to finance generation with power revenues; action on bond proposal may be similar since behind both is concept of self-supporting agency

Congress' pending action on Tennessee Valley Authority's plan to buy generating equipment with its power income may blaze the Congressional trail for a proposal to authorize the agency to finance new projects with revenue bonds. Behind both plans is the concept of a self-supporting TVA.

Ike Backs New Unit, Bond Plan

President Eisenhower backed the agency's request earlier this year for a $3.5-million appropriation to get a new $28-million, 180,000-kw unit started at John Sevier Steam Plant. He also endorsed the idea of completing payment on this and two new 135,000-kw units at Johnsonville with receipts from revenue bonds.

Since then, Congress has been considering the revenue bond measure, but it has not taken any action. So TVA, forecasting a 500,000-kw power shortage unless a start toward new capacity is made this year, moved quickly to get a new unit in the works.

Counsel Ok's Power Income Use

Acting on advice of its general counsel, the agency earmarked income from power sales to back up letters of intent to suppliers ordering the $3.5 million in equipment Eisenhower had asked Congress to vote money for. TVA's legal staff had indicated that, although it clearly prohibits payment of power sales income for new projects, the law does not prohibit financing new units at existing projects with power revenues.

Eisenhower's Budget Bureau endorsed this view. It upheld the position that TVA needs the new unit and that it should be permitted to order it pending Congressional action on the President's initial appropriation request.

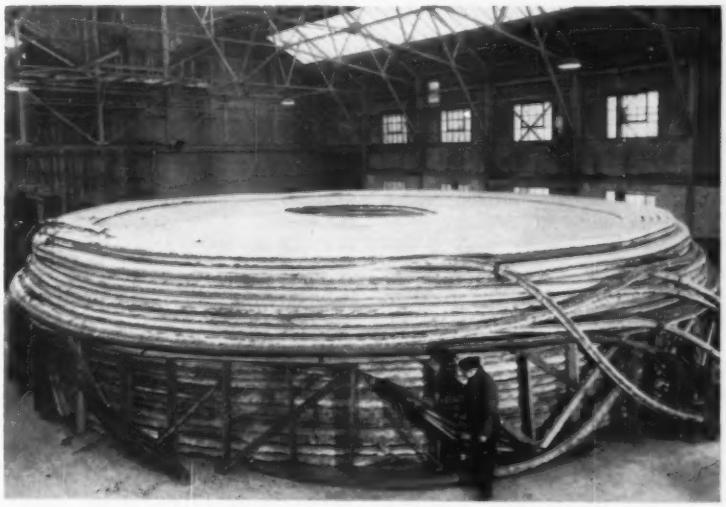
Recently Congress took the first step toward underwriting this plan. A House appropriations subcommittee voted in favor of the move, and passed its recommendation on to the full committee. A full committee vote had not taken place as EW went to press, but endorsement of its subcommittee's vote was anticipated.

This favorable view taken by the committee is important, not only because it probably will result in authorization of another new generating facility for TVA but also because it sets the stage for later approval of the revenue bond plan. The same leaders in Congress who are backing the John Sevier short-cut will be pushing TVA's revenue bond bill through the Congressional mill.

The plan would ease an Administration headache, too, for plant investment financed by sale of bonds could be kept out of the government spending column in the national budget.

Hearings on the bond bill were held last year by a Senate public works subcommittee. That group has had several closed meetings this session. Discussions have centered on the question of prior Budget Bureau and Congressional review of facilities TVA would construct with bond receipts, geographical limitation on TVA's service area, and terms and conditions of bond offerings.

So far, no agreement has been reached among subcommittee members, and the next meeting has not been set. But it is expected that differences will soon be ironed out and that a bill will be ready for action within the near future.



Shell Oil Lays 17-Mi Submarine Cable

Two 17-mi long submarine cables, reportedly the longest of their kind in the world, are going in at Shell Oil Co's Venezuela field operations. The 3-core, 33-kv double line, shown in construction above, will transmit power to production stations handling oil from Lake Maracaibo wells.

Electric energy has been given preference in Shell's $3.2-million development program in the lake's area because of its low operating costs, reliability, automatic control, and reduced space requirements.

The pair of cables will be laid from the power station at Las Morochas on eastern shore southwest for 17 miles to a Lake Maracaibo transformer built on lake bed pilings. The supplier, Siemens Bros & Co Ltd, London, expects to finish laying the cables this month.

Power will be distributed from the transformer by means of 11.5-kv submarine cables. Additional transformers at production station sites will step down voltage to operate 440-v electric motors.

Telegraph Construction & Maintenance Co, Greenwich, England, is furnishing the 11.5-kv cables which will be laid by Shell barges.

PG&E Plan to Buy BR's Falling Water Kinked

. . . by California city utilities which resolve public agencies be given right to buy power from federal projects' falling water

A resolution aimed at curbing Pacific Gas & Electric Co's proposal to buy falling water from the Bureau of Reclamation (EW, Mar. 7, 1955, p 17) was passed recently by the California Municipal Utilities Association.

Passed at the association's 24th annual conference in Los Angeles, the resolution called for the federal government to "make available to local public agencies in the state the right to purchase electrical energy generated by falling water from the authorized Trinity River Project in northern California."

The resolution covered all other federal multi-purpose projects that might be built in California. It also stated that "transmission lines be provided where necessary to transport power generated by falling water to these public agencies."

Issuance of bonds for the proposed Feather River project in northern California, or any other project in the state, has been blocked by the U. S. Supreme Court's decision on Portland General Electric Co's Pelton project (EW, June 13, 1955, p 63), State Senator Edwin J. Regan told the association. He added that a reversal or an act of Congress is needed to pave the way for sale of bonds. It is believed, said Regan, that the decision sets aside long-established water law and gives the federal government jurisdiction over practically all state waters.

Cites Nuclear Plant Costs

Discussing the future of nuclear power, Dr A. B. Martin, Atomics International Division, North American Aviation, told municipal delegates that nuclear plants will cost $300 per kw and fuel will cost 10-12 mills per kwhr. Availability of uranium is not a deterrent, he explained, because the supply is about equivalent to known coal reserves.

There is a new interest in thorium as a fuel, said Martin, because U-233 is produced in the fission process. The next few months, he added, will prove out some of the reactor types under study by the Atomic Energy Commission.

Residential underground distribution systems held focus during a panel discussion. E. A. Finley, Pasadena Light & Power Dept, told of a system that cost the subdivider only $150 per lot for ducts, pull boxes, and manholes. In this installation, the department provides service to secondary pull boxes at its own expense.

System Financing Plan Proposed

Walter Heston of Electrical West, suggested management consider the financing of residential underground systems through a special rate or surcharge which would amortize the added cost over equivalent overhead during the life of the installation.

The association re-elected Carl L. Richey, Sacramento Municipal Utility District, as president and Paul Beerman, San Diego Water Dept, as vice president for the ensuing year. G. A. Baxter, Alameda Bureau of Electricity was re-appointed treasurer. F. V. Frey, Pasadena Light & Power Dept, was re-appointed secretary.

New Uranium Source Studied

. . . as ore extraction from lignite beds, now in experimental stage, seen to aid U.S. supply, end reliance on other nations

A privately financed pilot plant soon to be constructed at the Colorado School of Mines may produce within six months technical information on extraction of uranium from lignite beds which may have a "significant" impact on the uranium raw materials picture in this country.

Uranium-bearing lignites have been found in extensive areas of western North and South Dakota. These do not lend themselves readily to reduction by metallurgical techniques applied to standard uranium ores.

If the pilot plant experiment being run by Ohio Oil Co and Arthur E. Pew, Jr, of Philadelphia, proves successful, a broad new source of supply, perhaps equal to Colorado Plateau's output, may be brought into being within three or four years.

Successful development could mean the foreseeable end to U.S. dependence on foreign nations as an important source of atomic fuel. This, perhaps, would not have much significance from an economic standpoint in the production of power, but it would mean that even in time of war U.S. atomic utilities would be assured of a continuing supply of fuel.

Preliminary work has been so promising the Atomic Energy Commission has agreed to negotiate a contract with the Ohio Oil-Pew group for purchase of a given quantity of uranium concentrates extracted from the lignites, if the experiment shows this can be done economically and on a grand scale.

First step would be construction of a full-scale extraction mill, to go into operation by the fall of 1957. The Ohio Oil-Pew mill would be able to handle ores mined by other private interests.

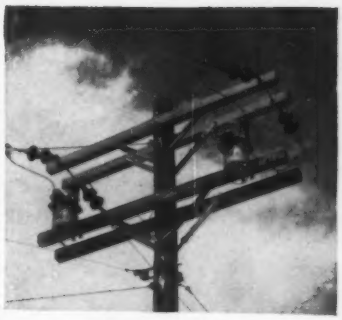
Although the limiting factor being investigated by the pilot plant's backers is mining costs, there's another bugaboo which has not yet been ironed out—extent of the richer uraniferous lignite deposits. As stated, deposits have been found over a broad geographical area, but investigations have not yet shown their potential.

Fear is that, although deposits may cover extensive areas, they may run only 12 to 18 inches deep. If so, open pit mining would be the most practical approach.

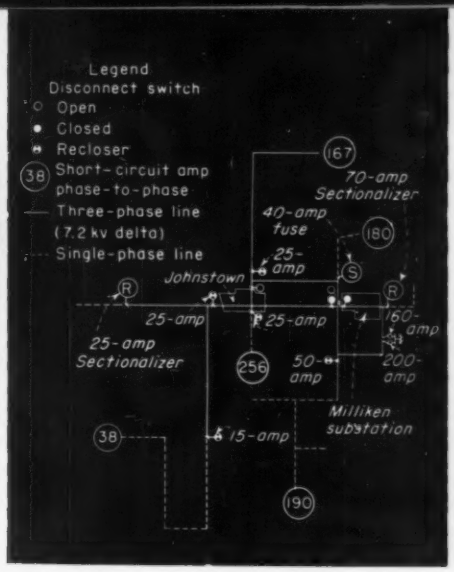
The hope is that deposits will average 0.2-0.4% uranium in raw lignite, dry basis. AEC experts say, if the carbonaceous matter in the lignites were burned off, this could be upgraded perhaps 50% or more. But they also point out that most lignites will not even sustain combustion.

Automatic

Reclosers . . .



And Sectionalizers . . .



For Rural Area of Colorado Utility

DISTRIBUTION—Design

Prove Automatic Protection Justified

HOWARD S. SMITH, Distribution Engineer, Colorado Central Power Co, Englewood, Colo.

Protection of rural circuits with reclosers and sectionalizers may be justified on an economic basis for circuits having a low energy consumption where transient fuse-blowing requires many man-hours for service restoration. In applying an analysis to 7 and 13-kv rural lines, Colorado Central Power Co finds the key factor is the time spent in restoring service on lines protected with fuses and manual sectionalizing switches.

To determine how much money can be justified for automatic protective devices, this analysis may be used:

1. From field outage reports, separate transient and permanent line outages over a two or three-year period and tabulate as an annual average.

2. Determine man and truck-hours cost for a two or three-year period and tabulate as an annual average.

3. Estimate revenue losses because of outages over a two or three-year period and tabulate as an annual average.

4. If permanent faults are predominant in one area, which has a small load and can be properly sectionalized, the losses in revenue because of improper sectionalizing plus the cost of crew patrolling time should be tabulated on an annual basis.

5. All other costs which can be reduced by reasonable sectionalizing should be tabulated on an annual basis.

6. Evaluation of customer good will, which must be considered, cannot be reduced to a dollar value. However, continuity of service will be a deciding factor if rural load is to continue to increase. The increased revenue based on this intangible factor of good will should more than account for the maintenance of protective devices. It also will allow a margin of economic gain in favor of reclosing devices.

Add the annual costs as determined in items 2-5 and multiply by six. This figure is the amount of money that can be spent for protective devices for the area considered. This calculation assumes an average fixed annual charge of 16⅔% on the investment in protective devices. It also assumes that the economic point of investment is reached when the total cost of outages per year is equal to the fixed annual charge on the investment to reduce outages.

An analysis of the Milliken substation area of Colorado Central Power, shown in the diagram, will illustrate use of this method of calculation. Cost of transient and permanent faults, the total amount justified for automatic protection, and the cost of this protection are listed in the table. Note that the allowable economic figure is $1,030 more than the economic figure. Thus the protective scheme is economically sound. Future fault data may justify replacing the fuses to the north of Milliken with reclosers.

Analysis of Economic Automatic Protection

Date from field outage reports:		
1. Transient outages, 18 per year		
80 man-hr @ $5/hr	$400	
50 truck-hr @ $1/hr	50	
3,000 kwhr lost @ $.02/kwhr	60	
Cost of fuse links	10	
		$520
2. Permanent faults, 3 per year		
4 man-hr lost due to improper sectionalizing @ $5/hr	$20	
2,000 kwhr lost due to improper sectionalizing @ $.02/kwhr	40	
		$60
3. Total probable outage cost		$ 580
4. Allowable economic investment ($580 x 6)		$3,480
5. Estimated installed cost of protective equipment*		
11 reclosers @ $190 each	$2,090	
4 sectionalizers @ $90 each	360	
		$2,450
6. Difference in favor of automatic protection		$1,030

*Including installed cost of crossarms and hardware

M&S CATALOG was produced by having all stores items typed on cards and inserted in special panels. When panels had been filled with cards, the panels were photographed in company's own office. This greatly reduced cost of catalog

Catalog Speeds M&S Procedures

MANAGEMENT
Accounting

Saves Public Service time, money and storage space in offices and storerooms and expedites purchasing department operations

EARL H. CONWAY, Vice President and Comptroller, Public Service Co of Indiana, Inc, Plainfield, Ind.

A materials and supplies catalog saves Public Service Co of Indiana time, money, and storage space. Much paper work has been eliminated, more adequate control is maintained, and the company adheres now to modern control principles.

The catalog covers only substation, transmission, distribution, and general items. But the company is now engaged in preparing another one of materials used by generating stations. This will be kept separate from the catalog of line items. But the experience obtained with the M&S catalog will be applied to the new listing, which will be on a functional basis, associating groups of repair items with the respective units.

About three years ago Public Service began modernizing the M&S records in use since 1929. The size and scope of the utility's service, involving varied construction, is reflected in its stores requirements. Its operation covers 70 of the state's 92 counties. It produces, purchases, transmits, distributes, and sells electricity to more than 350,000 residential, agricultural, and industrial customers in 720 cities and smaller communities, and adjacent rural areas. Service is supplied wholesale to 45 municipal utilities, 31 rural electric membership corporations at 109 separate connections, and one utility company.

The old stores methods required maintenance of index card files of all items. In assigning code numbers, a block system of numbering by classifications was used. But acquisitions, consolidations, and mergers had used up all the regularly available numbers so that it had become necessary to improvise. Thus hundreds of items had numbers not related to their classifications.

Changing techniques also created need for new items, and increasing customers reduced the usefulness of records. Timely accounting was handicapped by the difficulty in identifying materials, causing serious delays at general offices and 38 field storerooms.

The company decided that a catalog would be the cornerstone of modernizing M&S records. Economy was primal, both in compilation and operation. Some materials, largely obsolete, would have to be retained for replacement, but at least $50,000 worth of non-usable materials could be written off and eliminated. Work on a new catalog began late in 1953.

It was put in use in November 1954. In devising the new system, these were the objectives:

1. Reduction in inventory of items regularly carried.

2. Establishment of means for determining and providing the best storage location for given items.

3. Better control and selection of items.

4. General improvement in standardization processes.

Requisitions Expedited

Through these the company expected to arrive at common descriptions and a standardized numbering system for all departments and locations, thus expediting the handling of requisitions. When personnel know exactly what to ask for, interchange of items among storerooms would be facilitated and reporting by storerooms more rapid and accurate. Personnel training would be less difficult, as once a storekeeper was familiar with the system he could perform anywhere. There would be thorough standardization of items, nomenclature, and numbering.

The company has reached about all objectives and is enjoying practically all benefits anticipated. To perpetuate the new system mechanically, it adopted a Flexoprint-type of reproduction process.

Preparation Was Necessary

About 50,000 stores cards each carried an item number and what purported to be a description, but there was no assurance that materials conformed with these descriptions.

Over the several years, many people had worked on the record, some not too painstakingly. Items were recorded not only on the 3 x 5-in. cards but also on tabulating cards, using the old stores system.

CATALOG PAGE is shown being photographed in preparation for its reproduction by offset process. Elimination of standing type is in itself a saving

In converting, Public Service had to provide for all usable material in stock, keeping only such old descriptions as were complete and accurate. The 3 x 5-in. cards were reproduced by photographing them on large sheets, 36 cards at a time. The company obtained 5 x 6-in. cards which in the upper half carried the old information and in the lower provided space for a new description and other pertinent information. While these cards were being reproduced, the company arranged materials into classifications, seeking the most logical grouping and standard terminology for each.

A worksheet was designed to help resolve information and descriptions into final shape for transcription to the bottom half of the 5 x 6-in. cards. Thus group description standards were tentatively set up. When items no longer useful had been pinpointed by the engineering department, final classifications were established. Reviews and conferences among engineering, accounting, and stores personnel finalized the standard descriptions, and classifications, groupings, and unit measurements were established.

A fairly standard interval of numbering was used, with spacing allowed for future needs. The 5 x 6-in. cards went to typists who put the developed information on the new cards, each item on its own card. Once typed and proofread, the cards were inserted in proper sequence on special panels, photographed, and the catalog pages reproduced by offset printing. The panels were then stored in fire-proof files available for corrections, deletions and additions.

No Type Standing

During reproduction of the first edition, the company had the 5 x 6-in. cards tab punched to convert from old to the new stores item numbers. This provided a cross-reference between old and new numbers, making it possible to supply field storerooms with a complete listing of the reclassifications.

All production of the catalog by the newly adopted process is done in the company offices. Corrections, deletions, and additions are made with minimum effort in a short time. The catalog has been kept accurate and up-to-date.

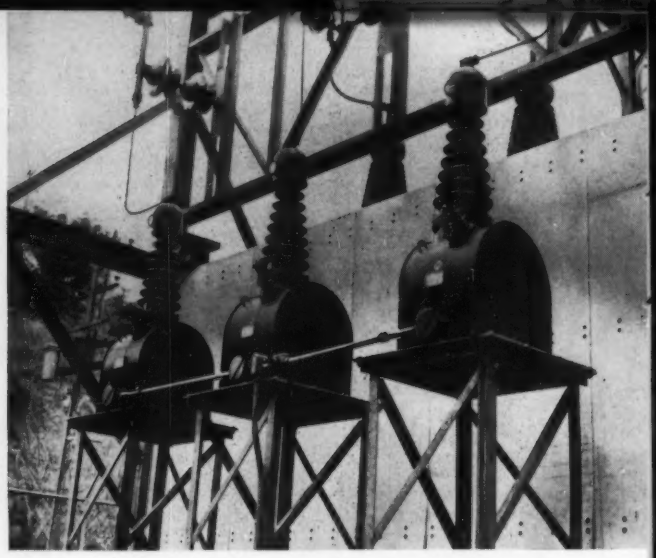
In perpetuating the catalog, new and/or corrected cards are given to

(*Continued on page* 242)

ROBOT CARD INDEX unit is being used by a clerk in purchasing department

By Using Special Design . . .

Potential Transformers Withstand Cable Charging Kva



SUBSTATIONS
Design

Standard design is modified with a minimum of changes so that costs are kept down but accuracy and clearance are maintained

C. E. GLATZ, Engineer, Allis-Chalmers Mfg Co, Pittsburgh, Pa.

J. L. DAVIDSON, Planning Engineer, Long Island Lighting Co, Hicksville, New York

Application of long 69-kv oil-filled cables has brought with it problems of handling the charging kva. To solve this problem on the Long Island Lighting Co system, potential transformers of special design were developed.

Several years ago, LILCO faced the problem of switching a 12-mile, 69-kv cable without the benefit of a wye-connected power transformer permanently connected to act as a charging kva drain after switching. Similar problems have been encountered with three other cables (3, 6, and 9 miles long) since the initial installation. A fourth cable (9 miles) is under construction.

System relaying and synchronizing required that potential transformers be connected on the cable side of the oil circuit breakers, so they would remain connected to the cable regardless of switching. This would subject primary windings to the full discharge current whenever cable was de-energized. Charging current of the 12-mile cable is equivalent to 25,000 kva at normal voltage and 100,000 kva, at twice rated voltage, which might occur during breaker opening.

Consideration was given to using capacitor potential devices. This may have resulted in leaving a relatively high voltage on one or two phases of the open cable. Then, when the circuit breaker was reclosed, a restrike might occur producing much higher voltages. Therefore, some form of drainage was desirable, and potential transformers were chosen.

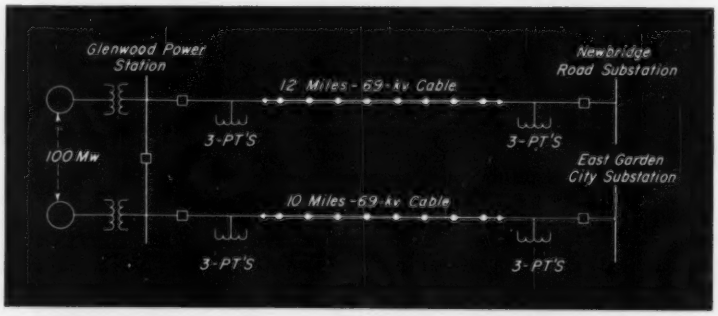
The early high-voltage, oil-filled cable installations were from four to six miles long. In general, a wye-connected power transformer was permanently connected to at least one end of these cables, and switching was done on transformer low-voltage side. In this manner, capacitive currents were not switched directly as power transformer windings acted as a discharge path to ground after the breaker opened. As the new potential transformers were to be subjected to discharge current normally handled by much larger power transformers, a special design was required for them.

Capacitance of the 12-mile 69-kv cable was approximately 10 microfarads per phase with potential transformers connected line to ground. Peak voltage used for calculations was 110 kv, allowing some margin of safety over the maximum anticipated peak voltage. Under these conditions core iron is rapidly saturated, and transformer is considered to consist of the primary resistance and the air core inductance of the primary winding.

Normal potential transformer applied to a long cable would fail with these operating conditions because of internal mechanical forces developed under discharge. Design problem was to provide necessary mechanical strength while maintaining reasonable metering accuracy and physical size.

Complete analysis was made in-

POTENTIAL TRANSFORMERS remain connected to cable when breakers open. Arrangement is required for system relaying and synchronizing



cluding a calculation of primary resistance, a check of transient circuit, and calculation of force between primary coils. As desired results could not be obtained with a standard unit, design was modified and calculations repeated.

Primary resistance was increased to limit discharge current and hence reduce the force. This was accomplished by increasing number of primary turns. Coils were modified to provide increased stress areas.

Changes Kept to Minimum

To effect economy of production, to maintain ample clearance distance for insulating, and to maintain a reasonable metering accuracy, the differences in structure from a standard potential transformer were kept to a minimum.

Multi-layered primary coils having several primary turns per layer were used. Layer insulation differs from crimped paper insulation normally used, and the coils were wound on preformed winding tubes for additional coil strength.

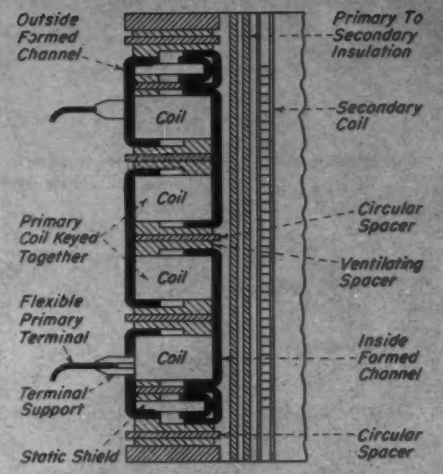
Potential transformers designed as above have relatively high-resistance primary windings. Metering accuracy is not quite so good as that of a standard potential transformer but is satisfactory for most metering and relaying applications.

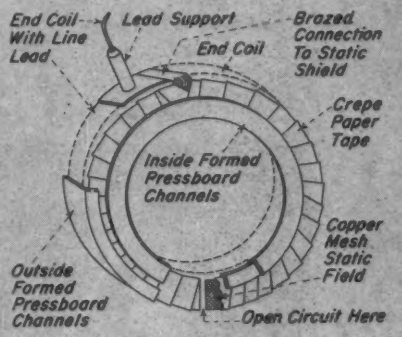
In Service Since 1952

First of these transformers installed on the Long Island Lighting System, has been in operation since 1952. Before the first cable installation, Long Island Lighting installed three transformers on a 25,000-kvar capacitor bank and subjected them to switching tests that were being made to check circuit breaker performance. Transformers were connected wye-wye, and current measurements were made in neutral connection of the primary windings of the potential transformer to record any dc current being drained from capacitor bank following switching. Resistance measurements were made on primary winding before and after each test to determine any temperature rise occurring in the primary winding.

Transformers performed adequately, and there was no indication of excessive temperature rise or of mechanical stress. Neutral currents measured were lower than those which might be expected at twice normal voltage, but period of discharge was quite close to calculated value.

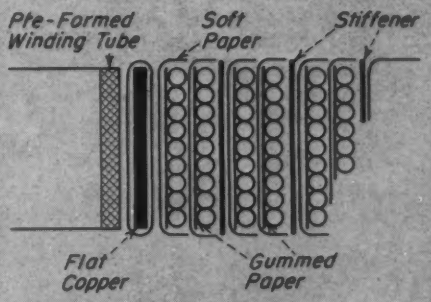
STATIC SHIELD is used to protect insulation of the end coils. The copper mesh shield is carefully insulated from ground

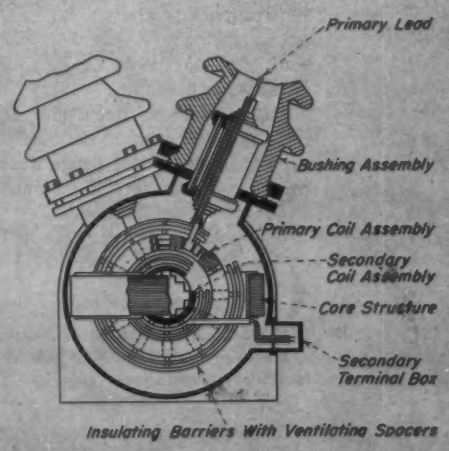




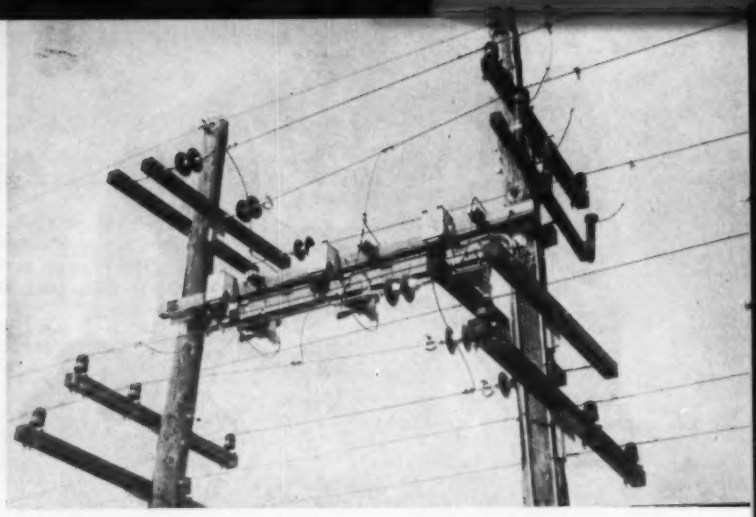
FORMED CHANNEL insulation is used on primary coils to eliminate corona. The structural modifications were kept to a minimum

MULTI-LAYERED primary coils were wound on preformed winding tubes in order to give additional strength





TRANSFORMER is constructed to withstand high mechanical stresses produced by discharge currents of the high voltage cables



METERING of 3-phase 12-kv lines is done on two-pole structures to obtain sufficient clearance between equipment

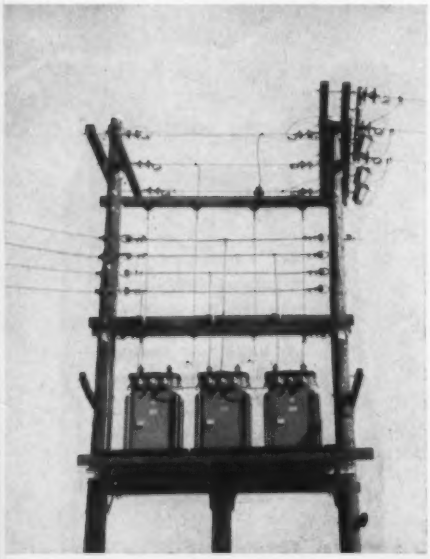
Best 12-Kv Design Cuts Total Costs

DISTRIBUTION
Design

Georgia Power Co has found that the operation and maintenance savings more than offset additional cost of the better system

T. W. TILLMAN, District Superintendent, Georgia Power Co, Columbus, Ga.

Economical operation and maintenance of 12-kv distribution begins with adequate initial design. It cuts labor and other expenditures for changing poles, lines, and equipment that become prematurely obsolete with rapid growth. And these savings more than offset any additional investment for the better system.



CENTER PROP reinforces platform of a two-pole structure that is used for larger transformers

In addition to the costly change-outs, Georgia Power Co's experience since 1945 proves that a number of other problems arise when the initial design is not adequate. Among these are:

1. Hot-stick work on small conductors is hazardous.

2. Outages are required to replace or string new conductors.

3. Adequate clearances must be maintained because a flashover at this voltage will burn down wire or damage equipment.

Poles Must Be Checked

To offset these difficulties and minimize outages, more sources of power and sectionalizing points are required. Also, lightning arresters must have low-resistance grounds to prevent equipment failures. For the same reason, metering should be installed on two-pole structures.

Of course, the poles and equipment must be checked periodically to keep costs down and locate incipient troubles. And safety is continuously stressed to avoid accidents.

No system is stronger than its back bone of creosoted poles and cross-arms. Although the poles appear good, they may be bad below the ground line. The best way to examine a pole is with the ball of a machinist's hammer—not with tools that mutilate the pole causing early failures.

Poles Tested With Hammer

The pole is struck with the hammer slightly below the ground line. If the outside portion is decayed, the hammer will go through; and the sound will indicate when a pole is hollow.

Bad poles are replaced immediately. This practice was established because sad experience proved if the bad poles were passed temporarily, the next time they came to mind was when they were down in the street. Replacing down poles is more expensive, to say nothing of the interrupted services and accompanying bad publicity.

Pole Height Important

Installing too short a pole initially is a costly mistake. On 12-kv systems a 40-ft pole should be the minimum, except for single-phase taps through rural sections. Poles of 45 ft or higher are needed for transformers and corners. And above all, the class of

Adapted from a paper presented at the Southeastern Electric Exchange Engineering & Operation Section meeting in Charlotte, N. C.

pole should be adequate for heavy loading, where necessary.

Size of crossarms must be carefully planned for each job. Extra strength is needed when spans are long or large wire is installed. Only metal pins should be used because they will not deteriorate from corona.

Replacement of poles and crossarms for 12-kv circuits is not too difficult, except at corners and heavy-angle poles. At these locations the deadends can be changed with the circuit hot, but it is very expensive and slow.

Wire Size Important

Size of wire initially installed is very important on a 12-kv system. If the wire strength is low, hot-stick work is very hazardous. When it is necessary to replace a small conductor or string new ones on existing arms, the circuit must be de-energized. This is not only expensive but furthermore is a source of numerous complaints.

Clearances must also be maintained. Flashover of a 12-kv line usually burns down the wire because of the enormous short circuit currents. Replacement of insulators, however, is simple. A good hot-stick crew can change them as fast with sticks as when working on lower voltage insulators using rubber goods.

175 Reclosers Installed

Pole-type oil reclosers are the answer to the operating man's prayer. About 175 reclosers are installed at strategic points in Georgia Power's Columbus Division to insure proper operation. Their locations are coordinated with other breakers to prevent fault current from locking out back-up breakers. No breaker is larger than 50% of the back-up breaker rating.

For example, on a feeder where the first recloser is 100 amp, the second breaker is 50 amp, the third is 25 amp, and the fourth is 10 amp. No fuses are connected in series with pole-type breakers, but in branches the fuses are not over 50% of the breaker rating.

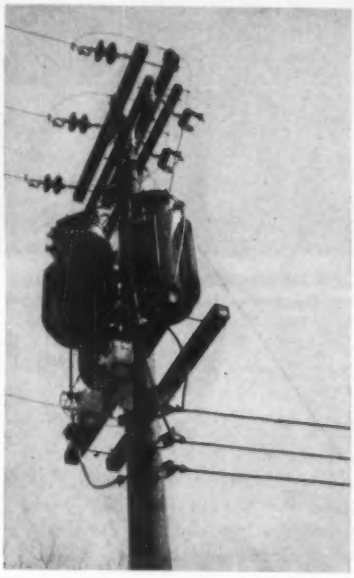
Grounded Deep

For each breaker location short-circuit calculations are made to insure proper interrupting capacity. Also, the breakers must have sufficient rating to be able to pick up the dead line load.

Maintenance of pole-type reclosers is done in the shop. Every two years or 40 operations the reclosers are replaced and completely examined, including electrical and mechanical tests and an oil change.

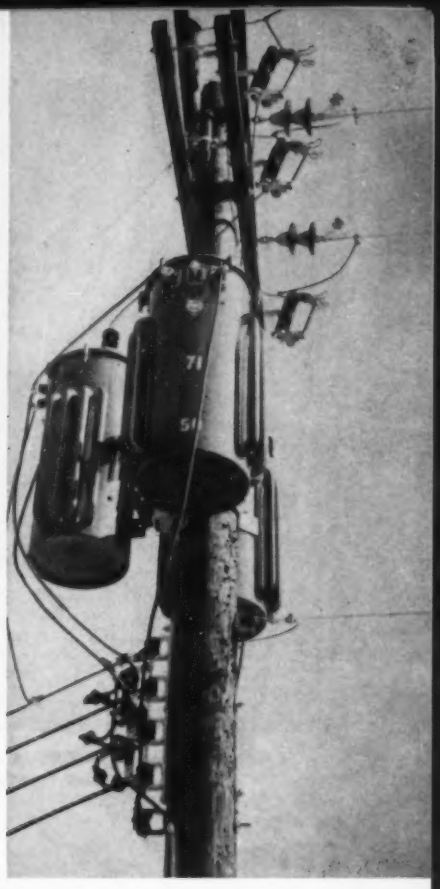
Lightning arresters are installed on both sides of reclosers and connected to deep grounds, the resistance of which is 15 ohms or less. The only recloser failure within the last seven years was caused by a direct stroke of lightning.

120/240-V 3-phase secondaries are run thru CT's mounted on rack



Switches that operate normally open need to be protected from lightning. In 1948 alone, 37 pedestal-type insulators were damaged. Replacing these insulators is a big job as both circuits must be de-energized, interrupting many customers.

Now lightning arresters are installed on the first pole on both sides of the normally open switches and connected to deep grounds, 10 ohms or less. Since this practice was adopted seven years ago, no insulator has been damaged. However, 32 arresters have failed, and at a few installations all three arresters were wiped out. But it's easier to replace arresters than switches, and the job can be done hot. Last year heavier arresters were substituted for the standard ones. Thus far, only three heavier arresters have been replaced.

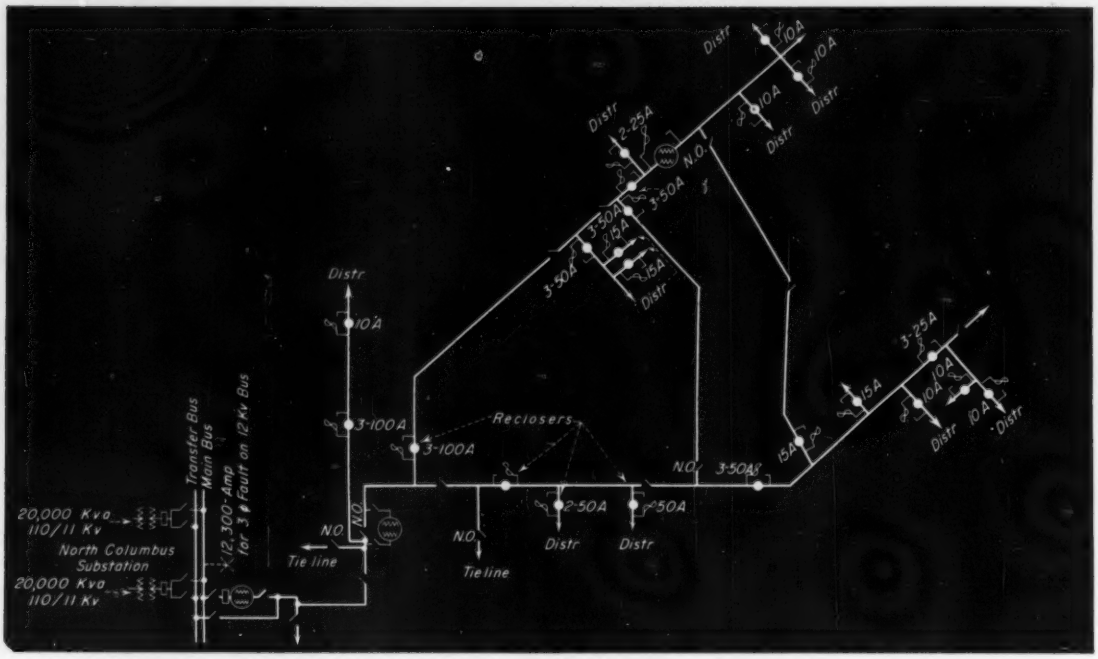


SECONDARIES of 3-phase 480-v bank are metered with CT's and pots mounted on the same arm

Because the success of arrester installations depends on low-resistance grounds, Georgia Power has been improving all grounds at transformer and recloser installations. The company, eight years ago, started at the end of each line and drove enough ⅝ x 8-ft section rods to reduce the resistance to below 15 ohms. And if lightning causes extensive trouble in an area, the ground-rod crew is sent out again to further improve the grounds. This program has eliminated most of the outages caused by lightning.

Connected on Line Side

Arresters are connected on the line side of transformer primary fuses to reduce outages and fuse replacements caused by lightning. For the same reasons the smallest primary fuse used is rated 15 amp. This simply protects the line if the transformer fails,



SECTIONALIZING FEEDERS in case of trouble is done with pole-type reclosers coordinated with other breakers. No breaker or fuse is larger than 50% of rating of backup breaker

and secondary fuses are installed to protect transformers rated 10 kva and lower.

Not Maintained in Field

Constant fuse blowing at a certain location can result from trouble that may be difficult to find. Some causes of difficult-to-locate trouble are: High-resistance lightning arrestor grounds, loose ground connections, broken ground wires, cracked or broken primary bushings of transformers, low oil level exposing terminal-board connections, bolts or other objects pertruding through or extending into transformer tank toward coils or terminals, and moisture in the transformer tank.

Distribution transformers are not maintained in the field because this is too expensive and inefficient. Instead, every transformer when removed from the line, regardless of voltage or age, is run through the maintenance shop in the following manner:

1. Oil is changed first.

2. Units are cleaned inside and out.

3. A high-pot test is made at 210% of rated voltage.

4. A ratio test is made.

5. Coils are examined, and dried if necessary.

6. Bushings and outside connections are examined thoroughly to stop moisture from entering the tank.

7. Tanks are painted.

The practice of changing transformer oil before tests are made resulted from failures during the high-pot tests. Water accumulated in the bottom of the tanks, and the transformers would flashover under test, even though they worked satisfactorily on the line. Moisture has been found in a large percentage of transformers having roof-type bushings. Changing the oil has greatly reduced the test failures. All oil is reclaimed.

Metering of 3-phase, 4-wire, 12-kv lines on a single pole structure is very difficult. Even when installed on 10-ft cross arms, the clearances between equipment are too small; and failures caused by lightning occur frequently. However, satisfactory installations can be made on two-pole structures. By changing to a two-pole structure at one metering location, instrument transformer failures, previously averaging three or four a summer, were eliminated.

On secondary metering doughnut-type current transformers are used where necessary. This makes a neat and economical installation.

Plugging safety is as important. Behind every accident is one contributing factor—someone wasn't thinking. There is no substitute for brains. The company wants no one who insists on being careless, and I have told more than one: "I'd rather fire you than bury you."

Street Lighting Multiple

Practically all street lighting circuits on Georgia Power's 13-kv system are multiple.

The utility has been using a mercury plunger relay that has proved very satisfactory in service. This relay has contacts enclosed in a tube of mercury which obviates the constant replacement of burned contacts experienced by Georgia Power with the older type of multiple relay.

For some time Georgia Power has been employing electric photo-cell street light control instead of time switches.

The company makes joint use with Southern Bell of most of the 12-kv system and ground brackets and mast arms on all street lighting installations.

A Special Report:

Characteristics of the All-Electric Home

The day is here when a home needs only two utility services—electricity and water. But how will it affect system loads, rates, and planning once its full brunt is felt? Here's what some utilities have found:

E. BRYSON SESSIONS, Commercial Editor

"All the all-electric home needs now is the industry's will to sell it. Once it gets going, it well could match the saturations of some of our most popular appliances today."

This comment of one industry observer pretty well sums up Electrical World's own opinion. When it gains Mr. Consumer's full recognition, the all-electric home will take its rightful place with television and air conditioning—another "horrible" load that has captured the public's imagination.

And as it does the stumbling blocks created by competitive fuels, adverse weather conditions, rates, concern over load factors, initial cost of equipment, and calculated cost of service will become progressively minor. Hints of this show up strongly in the pages that follow. Items:

- As customers become more electrified, distribution plant costs per kwhr become progressively less.
- Electric heating spurs greater use of other appliances—a notion long suspected, but supported statistically here.
- Utilities eventually will be serving all-electric homes not individually, but in large groups. Therein lies the hope for greater diversity not yet fully evident.

Material on the next 23 pages is a continuation of Electrical World's policy to gather and publish pertinent load data as they develop. It is hoped this latest effort will be found useful in evaluating what is possibly the greatest single load building opportunity yet to come the way of any utility.

WHAT IS AN ALL-ELECTRIC HOME?

It is a qualitative not a quantitative thing—at least at this stage of its market development. Basically it is a home in which all its energy requirements are supplied by electricity with full "housepower" wiring to handle it. At its best this home would be equipped with electric heating and cooling, all the appliances and housewares, full light conditioning, and all the new gimmicks and innovations, ie, closed-circuit television system, heating cable in the driveway, etc.

At the other extreme it could be a simple cottage with good lighting, a few basic appliances, and electric heating. The important thing is it would use no competitive fuels, whatsoever, thus leaving a wide-open market for future electric appliance sales.

IS THIS "IT"?

To call what we know now the ultimate word in all-electric living would be ridiculous. Today's housewife has some 56 electric appliances available. Edison Electric Institute President Harllee Branch, Jr, predicts she will have 100 appliances in the next 15 years. So-called all-electric "dream" homes back in the thirties were lucky if they could draw a 10,000 kwhr a year load. Today, the industry talks generally in the range of 20,000 and 30,000 kwhr. In the years ahead it's a safe bet that this too will sound like small talk.

IN THIS REPORT . . .

The Home Itself

Service — Page 124
Load Patterns — Page 130 and 133

Some Component Loads

Air Conditioning — Page 136
Resistance Heating — Page 140
Heat Pump — Page 142
Water Heating — Page 143
The Market — Page 146

Serving the All-Electric Home

In a new study, TVA examines the loads of its power distributors and the all-electric customers they serve. Its conclusions:

- **As use of the residential consumer increases, distribution plant investment is progressively less per kwhr.**
- **"Non-heating" appliances actually can contribute as much as 10% to 20% to a home's heating requirements.**
- **As this contribution increases, combination of heating and non-heating loads becomes more desirable . . . the more completely the home is electrified, the greater the diversity in demand.**
- **As the summer load goes up with air conditioning, better use is made of distribution capacity already provided for winter heating.**

WILLIAM R. NEW AND WILLIAM A. BELL, JR., Special Studies Section, Tennessee Valley Authority, Chattanooga, Tenn.

With about 155,000 of them now on its lines, the all-electric home is not just a consideration for the future, but a load of sizeable importance to the Tennessee Valley Authority.

Consequently a better knowledge of the load and its characteristics has become a matter of immediate necessity.

During the past year TVA conducted intensive study into the nature of these high-use residential loads and into the problems encountered in serving them. Data were gathered from tests made of a number of housing projects, each differing in its degree of electrification, and from operational studies made by various TVA distributors. Facts and conclusions from these investigations are summarized above.

As used here the all-electric home means a residence in which all heating and mechanical energy comes through the service wires. Space heating is now the chief load component of such homes in many sections of the country including the Tennessee Valley region.

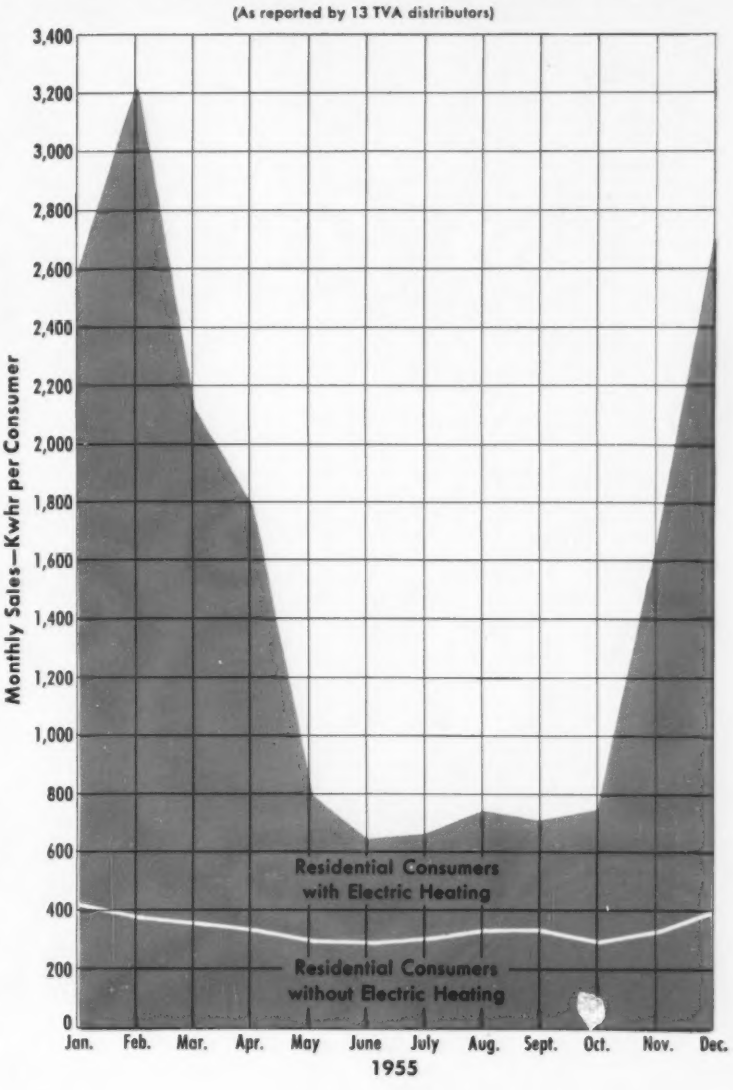
An important selling point of the heating load is its load building influence on other appliances. Most homes heated electrically use electrical energy for cooking, water heating, refrigeration, small appliances, and vastly improved lighting. Usually other heavy appliances, such as air conditioners and clothes dryers, can be added with little or no additional house wiring or distribution cost.

Evidence of electric heating's influence on saturation of other appliances is shown in Fig. 1 Data is based on actual statistics from a number of municipal and cooperative TVA distributors. Average summer consumption of the higher appliance-saturated all-electric home is almost twice that of the other group—strong indication that electric heat promotion is one of the best ways to sell the profitable appliance load.

In view of the multiplication of home appliances, a utility should recognize the heating contribution of these household appliances which can justify a reduction in the installed heating capacity.

One reason for apparent neglect of an analysis of all parts of the all-electric home load is the difficulty in obtaining a breakdown into components of the energy and diversified demand. Setting up special metering equipment for collecting the data has not been practicable. While energy use of appliances can be estimated from surveys, diversified demands and load factors of the appliances are not obtainable.

Fig 1—Average Monthly Energy Use: Residential Consumers with and without Electric Heating



But, TVA has gathered data from four low-rent housing projects having various combinations of electrical appliances. Major appliances used by each group, along with lighting are:

Group A—refrigerator

Group B—refrigerator and range

Group C—refrigerator, range, and water heater

Group D — refrigerator, range, water heater, and space heaters.

For perhaps the first time demand and energy data have been available from large groups of homogeneous consumers, each group having a different set of appliances. These data appear in Tables I and II. They show the energy components, demand components and load factors, respectively, obtained by subtractions. But certain limitations should be kept in mind. Consumption of each appliance may differ somewhat in these low-rent apartment units from that in a typical home. Relatively few small appliances are in use.

On the other hand, this difference may tend to afford more accurate figures for the use of each major appliance. For example, energy consumption of the range appears low, probably because apartment units in Project B are heated from a central source. There would hardly be reason for using the range for auxiliary heat, or for using portable heaters.

Diversified load factors of the non-heating load's components are shown, and the tables provide clues to the question: How much does the so-called non-heating appliance load contribute to the actual heating of the home? Although its investigation of this aspect is incomplete, TVA believes that in the Tennessee Valley this heat contribution is 10 to 20% of the season's heating requirements.

As this contribution increases,

Table I — Determination of Energy Consumption

Major Appliances — Apartment Groups

	Kwhr per Unit (Consumption of Project Divided by Number of Units)						
	Group A 480 Units	Group B 395 Units	Group C 437 Units	Group D 400 Units	B —A Range	C —B Water Heater	D —C Elec Heat
July '53	124	219	346	552	95	127	206
August	128	226	384	456	98	158	72
September	136	238	395	504	102	157	109
October	124	254	423	768	130	169	345
November	128	251	577	1,800	123	326	1,223
December	134	258	612	2,604	124	354	1,992
January '54	154	264	673	2,664	110	409	1,991
February	173	234	681	1,740	61	447	1,059
March	140	242	585	1,992	102	343	1,407
April	132	232	522	918	100	290	396
May	142	216	503	732	74	287	229
June	126	229	415	504	103	186	89
Total	1,641	2,863	6,116	15,234	1,222	3,253	9,118
Monthly Average	137	239	510	1,269	102	271	1,080*
July '54	132	226	354	444	94	128	90
August	158	229	387	480	71	158	93
September	144	248	387	480	104	139	93
October	153	245	426	888	92	181	462
November	133	248	615	1,938	115	367	1,323
December	145	232	623	2,664	87	391	2,041
January '55	181	272	684	2,724	91	412	2,040
February	158	266	692	2,280	108	426	1,588
March	156	222	538	1,692	66	316	1,154
April	145	240	552	912	95	312	360
May	148	210	445	504	62	235	59
June	127	240	415	528	113	175	113
Total	1,780	2,878	6,118	15,534	1,098	3,240	9,416
Monthly Average	148	240	510	1,294	91	270	1,128*

*Eight heating months, October-May.

Group A — Lights and refrigerator.
Group B — Lights, refrigerator, and range.
Group C — Lights, refrigerator, range, and water heater.
Group D — Lights, refrigerator, range, water heater, and electric heat.

combination of the two loads becomes more desirable. That is, serving the diversified demand of the all-electric home is more desirable, especially as the completely all-electric home, with its many minor appliances, would show even greater diversity.

These data do not indicate how the air-conditioning load fits into the rest of the non-heating load. But with regard to annual load factor the balancing effect of air conditioning may be estimated from Fig 2, in which TVA distributors' energy requirements for each Sunday from January through September, 1955, are plotted against the mean temperature. Selection of Sunday minimizes industrial and commercial use.

In Fig 2, points above the level of energy used at about 70F roughly approximate the heating load to the left of 70F and the air conditioning to the right. The data show that the January heating load was about four times the air-conditioning load. But as distribution systems on hot summer days lose 50% of their winter capacity for heating, the heating load on the coldest days may be safely said to be about 50% balanced by the air-conditioning load on the hottest days. As air conditioning increases the summer load utilizing more of the available heating capacity, service to the all-electric home is becoming increasingly profitable.

What service to more and more all-electric homes means in terms of system average residential use is revealed in Table III and Fig 3, based on the fiscal year 1955 operation of 13 TVA distributors. The distributors were not selected for any special effect, but constitute a group willing to undertake the extra expense of separating the billing of the consumers with electric heat from those heating by another method. Fortuitously, they range from 29 to 2% saturation of electric heat and from zero to 90% rural customers. Also by chance, the average residential use of this group is very close to the average of 5,206 kwhr for all TVA power distributors.

Table III provides major and minor appliance saturations for each sys-

Table II — Determination of Demands and Load Factors

Major Appliances — Apartment Groups

	Demand—Kw per Unit (Peak Monthly Demand Divided by Number of Units)							Monthly Load Factors			
	Group A 480 Units	Group B 395 Units	Group C 437 Units	Group D 400 Units	B −A Range	C −B Water Heater	D −C Elec. Heat	Lights and Ref	Range	Water Heater	Elec Heat
July '53	.36	.79	.88	.96	.43	.09	.08	48%	31%	>100%	−%
Aug.	.34	1.06	.81	1.08	.72	(.25)	.27	51	18	>100	–
Sept.	.32	.91	1.02	1.68	.59	.11	.66	57	23	>100	–
Oct.	.36	1.15	1.24	3.66	.79	.09	2.42	48	23	>100	20
Nov.	.38	.85	1.40	5.04	.47	.55	3.64	45	35	80	45
Dec.	.42	.91	1.65	6.72	.49	.74	5.07	44	35	66	55
Jan. '54	.44	.91	1.66	6.48	.47	.75	4.82	47	31	73	56
Feb.	.48	.94	1.62	5.04	.46	.68	3.42	48	18	88	42
Mar.	.43	.91	1.66	5.52	.48	.75	3.86	48	32	68	54
Apr.	.42	.91	1.47	3.84	.49	.56	2.37	42	27	70	22
May	.41	.85	1.30	2.52	.44	.45	1.22	48	23	89	26
June	.40	.88	.95	1.20	.48	.07	.25	42	29	>100	–
Total	4.76	11.07	15.66	43.74	6.31	4.59	28.08				
Monthly Avg	.40	.92	1.30	3.64	.53	.38	3.35*				
Avg Mo LF	47%	36%	54%	48%				47%	26%	98%	44%*
July '54	.38	.79	.78	1.08	.41	(.01)	.30	48%	32%	>100%	−%
Aug.	.36	.85	.82	1.20	.49	(.03)	.38	59	19	>100	–
Sept.	.37	.88	1.02	1.20	.51	.14	.18	52	27	>100	–
Oct.	.38	.91	1.40	3.96	.53	.49	2.56	56	24	51	25
Nov.	.40	.94	1.59	5.52	.54	.65	3.93	45	29	76	45
Dec.	.43	.97	1.54	5.52	.54	.57	3.98	47	22	95	71
Jan. '55	.48	.85	1.62	6.00	.37	.77	4.38	51	33	72	63
Feb.	.46	.97	1.65	6.48	.51	.68	4.83	46	28	84	44
Mar.	.45	.94	1.59	4.74	.49	.65	3.15	52	20	72	55
Apr.	.46	.94	1.70	3.12	.48	.76	1.42	42	27	55	34
May	.42	.93	1.21	1.44	.51	.28	.23	49	17	>100	36
June	.43	1.03	.98	1.32	.60	(.05)	.34	40	25	>100	–
Total	5.02	11.00	15.90	41.58	5.98	4.90	25.68				
Monthly Avg	.42	.92	1.32	3.46	.50	.41	3.06*				
Avg Mo LF	48%	36%	53%	51%				48%	25%	90%	50%*

*Eight heating months, October-May.

tem. Although these saturations were estimated from consumption frequency distribution, their accuracy was confirmed by a TVA area-wide appliance survey. (EW, Feb. 20, p 162.) A summary of this 60,000-consumer survey is part of Table IV.

The relationship of the saturations of range, water heater, and electric heat for these 13 distributors is pictured in Fig 3. The curves show saturations associated with average annual use for a system. Marked flatness of the range curve and the tendency of the water heater curve to flatten out as compared with the electric heat curve suggest that predicted average uses by these consumers are being attained.

Fig 2—Distributors' Load on TVA System

Sunday Energy Consumption—Jan.-Sept., 1955

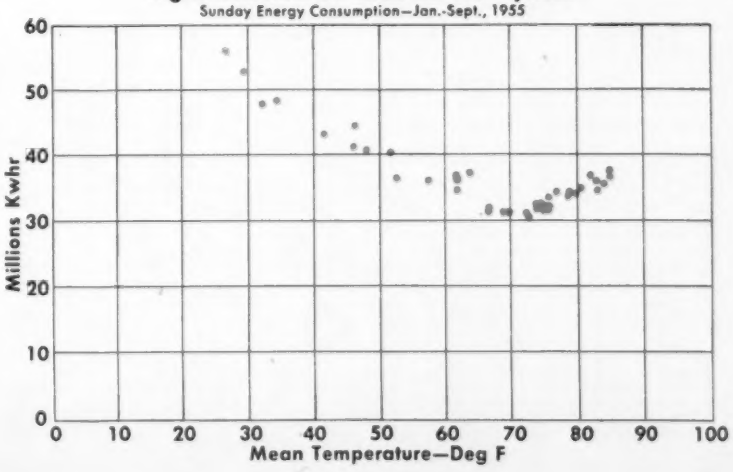


Table III — Appliance Saturations — TVA Power Distributors 1955

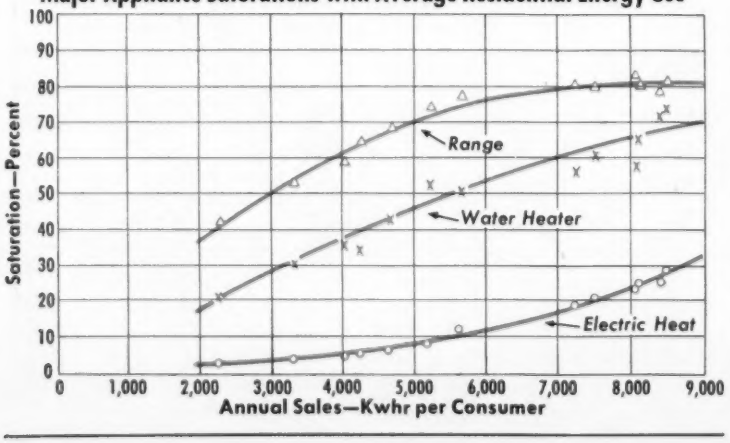
(Using Special Codes for Electric Heating Consumers)

Distributor	Avg Res Kwhr Use FY 1955	Rural Cons	Home Appliance					Heating Groups					Cooling	
			Ref	Range	Water Heater	TV	Food Freezer	Elec Heat Only	Reg EH & Other	Sometime EH & Other	Coal, Wood, or Oil	Gas	Attic or Window Fan	Room Air Cond
A	8,500	0%	91%	81%	74%	62%	17%	29%	1%	11%	47%	13%	34%	5%
B	8,420	0	97	79	72	47	11	26	2	13	31	29	47	19
C	8,210	16	95	80	66	70	6	25	3	11	50	13	28	12
D	8,195	1	97	83	58	44	8	24	6	13	53	8	46	6
E	7,494	0	92	79	61	70	12	21	1	8	44	27	39	14
F	7,234	19	—	80	56	30	12	19	4	13	36	30	50	6
G	5,654	77	94	77	50	49	17	12	4	12	71	1	11	1
H	5,229	62	97	74	52	32	18	8	2	6	75	6	25	6
I	4,672	0	93	68	42	52	21	6	2	10	13	66	68	24
J	4,250	73	96	64	34	42	13	5	5	12	68	6	24	3
K	4,019	0	93	58	35	23	10	4	2	9	19	65	61	17
L	3,331	87	95	52	30	19	31	3	2	7	47	40	33	8
M	2,297	90	93	41	20	43	38	2	2	4	44	46	41	13
Average	5,213	49%	94%	66%	44%	42%	20%	11%	3%	9%	49%	27%	35%	10%

Table IV — Appliance Saturations — TVA Area 1955

	No. of Cons 1,000's	Home Appliance					Heating Groups					Cooling	
		Ref	Range	Water Heater	Clothes Dryer	Water Pump	Elec Heat Only	Reg EH & Other	Sometime EH & Other	Coal, Wood, or Oil	Gas	Attic or Window Fan	Room Air Cond
Sat Among All Residential Cons	1,218	94.7%	62.2%	41.1%	3.5%		11.9%	2.6%	8.3%	51.6%	25.6%	0.7%	7.9%
Sat Among Urban and Rural Non-Farm Cons	777	95.1	62.8	49.7	4.8		15.6	2.7	8.4	39.6	33.7	1.0	11.0
Sat Among Farm Cons	441	94.0	60.9	27.4	1.1	35.6%	5.5	2.2	8.3	73.3	10.7	0.2	2.7

Fig 3—Relationship of Electric Heating and Major Appliance Saturations with Average Residential Energy Use



Economic conditions and gas competition have put a ceiling at about 80% saturation on ranges and probably will limit water heaters similarly. If service to the all-electric home is actively promoted, average annual uses in the order of 20,000 kwhr appear probable.

In selling electric power, utilities must concern themselves not only with units they can sell and the price at which to sell them, but also with the investment committed on a long-term basis for making these sales. Consequently the big question is: What investment is associated with service to the all-electric home? As its unusual total load characteristics limit the applicability of conclusions concerning generation and transmission, TVA restricted its study to cover distribution

Table V — Effects on Distribution Plant Costs of Serving the All-Electric Home

Dist Number	% of New Res Cons Added in Past 5 Years That Are All-Electric*	Percent All-Electric 1955	Average Annual Kwhr Use 1955** Per Res Consumer	Per Total Consumer	Distribution Plant Cost (Less Street Lighting) Per Kw 1955	Per Kwhr Sold 1955	Per Total Cons 1950	Per Total Cons 1955	% Increase Per Cons '50-'55	Annual Load Factor 1950	1955
#1	100%	30%	8,833	11,287	$61	2.02¢	$160	$228	42%	39%	38%
2	100	23	7,748	10,857	80	2.48	216	269	25	47	42
3	88	24	8,195	12,921	61	1.93	119	250	110	48	38
4	81	13	6,486	7,874	50	1.70	104	134	29	38	37
5	80	33	9,032	14,738	42	1.28	149	189	27	51	39
6	76	25	8,402	11,298	68	2.38	139	269	94	40	36
7	73	24	7,799	10,698	75	2.31	153	247	61	47	42
Average 70-100% Group		25%	8,071	11,382	$62	1.99¢	$149	$227	52%	44%	39%
8	68%	25%	7,612	10,399	$63	2.09¢	$127	$217	71%	43%	37%
9	68	13	5,797	7,899	80	2.70	165	213	29	45	39
10	67	21	7,509	10,407	60	1.87	137	195	42	48	40
11	66	29	8,500	10,313	62	2.10	105	217	107	47	36
12	59	23	7,943	9,273	59	2.06	159	191	20	41	36
13	48	11	5,255	8,081	67	2.02	121	163	35	52	42
14	45	15	5,398	8,343	81	2.53	119	211	77	50	40
Average 45-70% Group		20%	6,859	9,245	$67	2.17¢	$133	$201	51%	47%	39%
15	24%	11%	6,140	6,853	$78	2.32¢	$110	$159	45%	41%	43%
16	20	5	3,493	5,589	78	2.34	91	131	44	48	43
17	11	4	3,663	7,973	68	1.93	111	154	39	46	45
18	9	3	3,176	5,805	107	2.65	132	154	17	46	50
19	8	2	2,571	5,773	118	2.79	109	161	48	52	52
20	3	4	4,066	7,444	74	1.92	117	143	22	50	49
21	1	2	2,750	5,098	95	2.65	109	135	24	46	47
22	1	1	2,277	4,937	113	3.00	141	148	5	56	49
23	0	1	2,691	5,492	124	3.40	142	187	32	53	48
Average 0-25% Group		4%	3,425	6,107	$95	2.49¢	$118	$152	29%	49%	47%

*New all-electric homes added include both new homes and conversions of old homes to electric heat.

**All years in this table are Fiscal years.

plant investment exclusively.

For investigating the effect of service to the all-electric home on distribution plant investment, 23 systems were analyzed. Criteria for selecting these were minimum number of rural consumers and minimum industrial load. Table V groups these according to the percentage of new residential consumers in the past five years who were all-electric. Conversions to electric heat were considered new all-electric homes.

Systems whose new consumers were 70 to 100% all-electric had a distribution plant investment of 1.99¢ per kwhr, or $62 per kw. Those whose new customers were 45 to 70% all-electric had a distribution plant investment of 2.17¢ per kwhr, or $67 per kw. The group having less than 25% of its new customers in the all-electric class had a distribution plant investment of 2.49¢ per kwhr, or $95 per kw.

These figures show that distribution plant requirements are generally much less per kwhr, or kw, where service to the all-electric home is a large percentage of the total load. This is perhaps to be expected in view of well-known economies of fuller plant utilization. But the degree to which the fuller plant utilization occurs in spite of some reduction in annual load factor is the striking aspect.

To put these findings another way, again with reference to Table V, the group of systems having the highest percentage of new all-electric consumers averaged $227 per customer in distribution plant investment. The group with the lowest percentage of new all-electric customers averaged $152. The difference is $75 per customer.

With regard to the increment in the average kwhr delivered per customer, the $75 difference in investment is associated with an increase in average residential use of 4,646 kwhr or a total increase of 5,275 kwhr per customer. Allowing 15% for fixed charges, depreciation, and operation and maintenance, it is evident that this incremental load could be served at about 2 mills plus the incremental power cost.

Consequently there can be little doubt that serving a high saturation of all-electric homes has been a paying proposition for these systems.

How to Determine Your Own

- Cleveland Electric Illuminating Co does it by combining individual appliance and heating data taken from groups of homes
- Result: A composite picture of characteristics that aids in system, rate, and promotional planning

C. T. LOSHING, Project Engineer, Technical Studies Section, Cleveland Electric Illuminating Co, Cleveland, Ohio

Few electric utilities have studied many all-electric homes in their service areas. But many are concerned with the problems that will arise as the number of such homes increases.

Will design standards have to be changed? Will the present rate structure be adequate? Should we promote or discourage certain applications of electricity? Load studies help provide a basis for answers to such questions.

By knowing the load pattern of individual or combinations of large appliances, Cleveland Electric Illuminating Co believes it can synthesize load characteristics of the all-electric home in its own service area.

It follows this technique because its own peculiar problems, it feels, will more likely arise from increased saturation of large appliances than from the mushrooming of all-electric homes as such. It does not believe, however, that the impact of the all-electric home can be generalized from this local data.

Each utility should conduct its own load studies and evaluate results in the light of its own existing load pattern and system facilities. Living habits of customers and climatic conditions together mold the load shape of the all-electric home in an area. The economic desirability of this load depends upon how well it diversifies with other residential, commercial, and industrial loads.

In evaluating the economic effect of the all-electric home load, time and duration of peak, magnitude and saturation of the all-electric home load, and relation of the load to others (diversity) must be considered for the load itself and the system load at distribution secondaries, feeders, substations, and power plants.

But a fair approximation can be obtained from the proper combination of data from load studies of individual

Fig 1 — Group Load Shape: Customers with Electric Ranges, Dryers, and Water Heaters

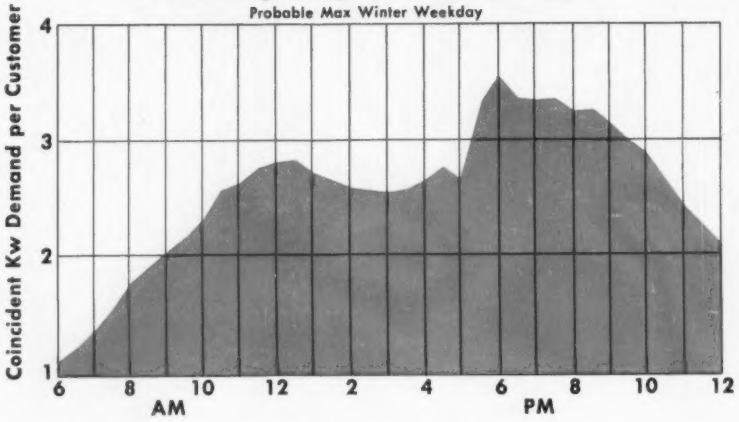
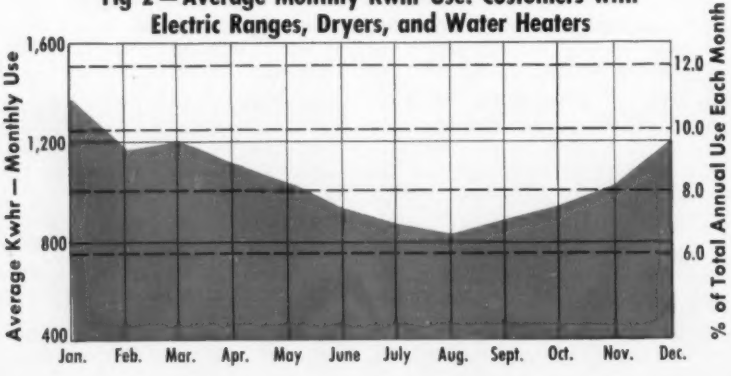


Table I — Summary of Annual Load Data for a Group of Homes with Electric Ranges, Dryers, and Water Heaters

Average Individual Maximum Demand	8.1 Kw
Average Annual Use	12,500 Kwhr
Average Individual Annual Load Factor	17.6%
Group Coincident Maximum Demand Per Customer	3.6 Kw
Average Group Annual Load Factor	39.6%
Group Diversity Factor	2.25

Fig 2 — Average Monthly Kwhr Use: Customers with Electric Ranges, Dryers, and Water Heaters



All-Electric Home Loads

major appliances and basic residential load patterns. Such approximations help a utility in the long-range planning of facilities to meet such a future load and in designing appropriate rate schedules. Such studies also serve as a useful guide in planning promotional activities.

For its own needs, CEI determined the load characteristics of a group of 40 homes, each having an electric range, dryer, and water heater. These homes also have the normal small appliances, including a refrigerator and lighting. Results of this study are summarized in Table I, in which kilowatt demands are on a 30-min clock integrated basis.

The diversified load shape of this group of customers appears as Fig 1. The group peak of 3.6 kw per customer is at 6:00 PM and the secondary peak of 2.9 kw at 12:30 PM, both probably attributable to the range load. Average annual use per customer is 12,500 kwhr.

These large homes have greater than average occupancy, group and individual load factors being probably higher than those expected from the more nearly average-size home. The seasonal pattern of the monthly kwhr use per customer appears in Fig 2, where use varies from a 1,375-kwhr January high to a low of about 825 kwhr in August. These homes have no electric heating.

Load studies of installations including such heating afford a good estimate of how individual and group load characteristics would be affected by the imposition of resistance electrical heating. Several years ago CEI made studies of 32 homes where resistance heating had been installed. All were designed and insulated for panel heating. Thus their electrical requirements for heating approximated the levels that could be expected for their sizes in the area. Major characteristics of the panel heating load are listed in Table II.

This data indicates that there is very little diversity among panel heating customers. In the heating season monthly individual load factor may average around 40%. While annual load factor is around 20% for the individual home, it is only 23% for the group of homes.

Fig 3 plots the group maximum

Fig 3 — Group Load Shape: Panel Heating Load Only

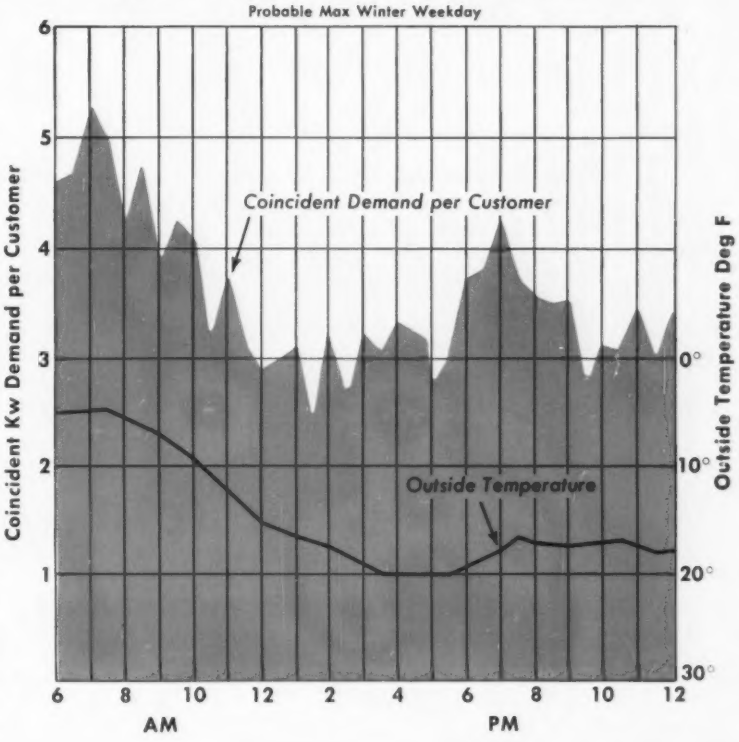


Table II — Panel Heating Load Characteristics

Average Heated Space	6,250 Cu Ft
Rated Capacity of Heating Load	7.9 Kw
Annual Use for Heating	10,500 Kwhr
Non-Coincident Maximum Load	6.3 Kw
Individual Annual Load Factor	19.0%
Group Coincident Maximum Load	5.3 Kw
Group Annual Load Factor	22.6
Group Diversity Factor	1.19
Normal Annual Degree Days	6,000

Table III — Estimated Annual Load Characteristics of the All-Electric Home

Average Individual Maximum Demand	12.7 Kw
Average Annual Use	23,000 Kwhr
Average Annual Individual Load Factor	20.7%
Group Coincident Maximum Demand	7.6 Kw
Average Group Annual Load Factor	34.6%
Group Diversity Factor	1.67

Fig 4 — Group Load Shape: Customers with Electric Ranges, Dryers, Water Heaters, and Panel Heating

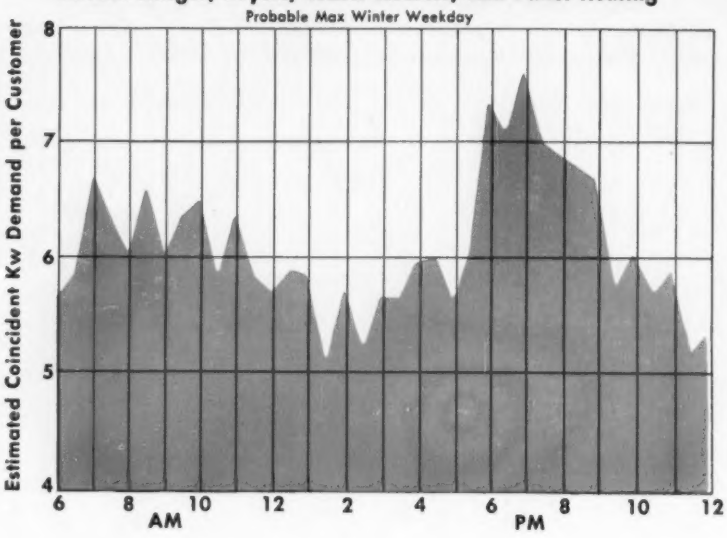
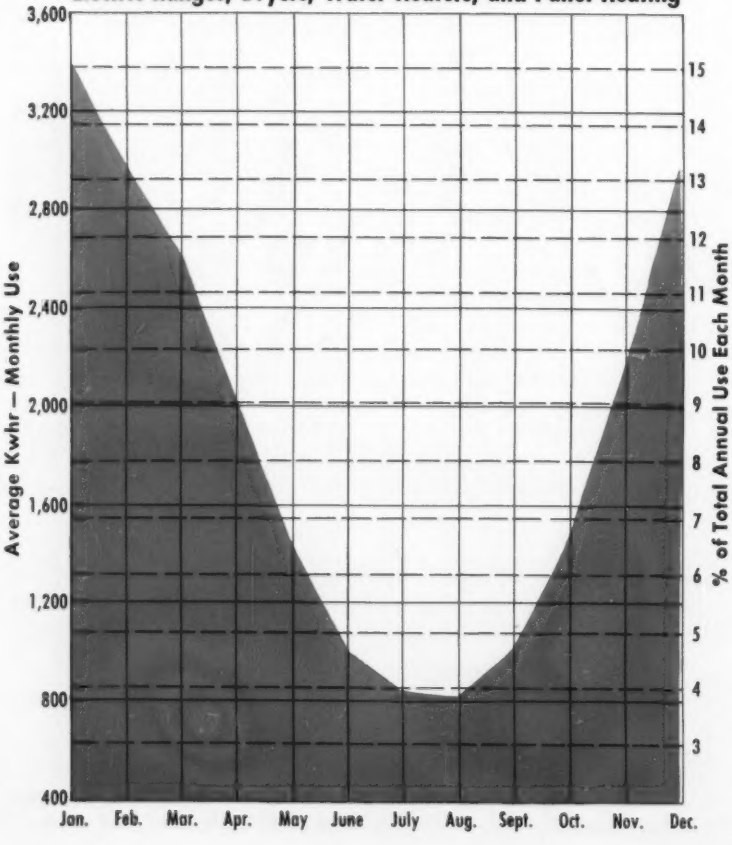


Fig 5 — Estimated Average Monthly Kwhr Use: Customers with Electric Ranges, Dryers, Water Heaters, and Panel Heating



load shape for a cold day, along with the hourly temperatures. The load shape peaks early in the morning, and has its secondary peak in the early evening. Many factors, such as outside temperature, thermostat setting, and the living habits of the occupants affect the panel heating load. Yet this general pattern of early-morning-and-evening peaks is consistently discernible.

Addition of the panel heating load to the group load of those customers having electric ranges, dryers, and water heaters, gives an approximation of the characteristics of the all-electric home. It is assumed, however, that the heating load maximum and the normal customer load maximum occur on the same day. Although the resulting peak may be slightly high, no allowance was made for intra-load diversity, as the adjustment would be less than the probable variance in the load studies. The composite load shape is developed in Fig 4, and Table III tabulates the composite load characteristics of the all-electric home.

In evaluating the effect of air conditioning in the all-electric home on its system, CEI would follow the same procedure. Air conditioning load characteristics would be added to summer load characteristics of customers equipped with electric ranges, dryers, and water heaters. Specific studies on air conditioning for home use have not yet been completed.

Addition of panel heating monthly kwhr use to the seasonal pattern of the range-dryer-water heater customer in Fig 2 provides the seasonal picture of the monthly use of the all-electric home (Fig 5) without air conditioning. From this it can readily be seen that addition of air conditioning might materially improve the customer and group annual load factors.

Desirability of such improved annual load factors depends upon overall system seasonal load pattern. When a company's annual plant load factor improves along with the individual customer's load factor, the addition of air conditioning would be particularly desirable from an economic standpoint.

Estimated individual load factors of the all-electric home, having resistance electrical heating, are somewhat higher than the present individual average residential load factor. The estimated group load factor of homes without air conditioning is slightly lower than exist today.

Average Winter Weekday Load Curves

(Average Weekday: Winter, Jan. 17-28, 1955)

Fig 1 — Customer A

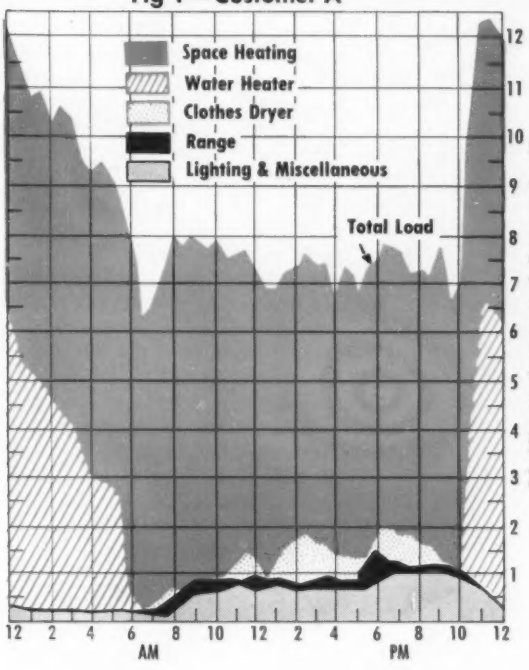
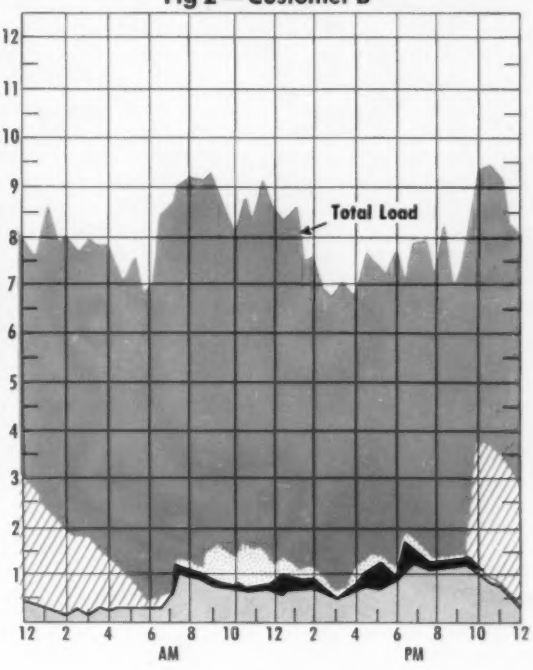


Fig 2 — Customer B



In Detroit: 32,000 Kwhr Plus per Year

- **Two homes studied by Detroit Edison each use that much power—even without air conditioning**
- **Space heating and water heating are dominant loads, but they tend to pull lighting and other uses up by the bootstraps, too**

In terms of energy use, the all-electric home today well could mean residences with connected loads of 45 kw and more, using 28 to 30 and even 35,000 kwhr per year.

Such are two homes studied by Detroit Edison Co. Admittedly, a study of such limited scope would not provide enough data to predict actual load characteristics. Nor would it indicate the diversified demand of a group of similar high-use customers. But the study did show three important things:

1. The vast potential of sales in the residential market.

2. The increases in individual demands these sales would bring.

3. The significance of major appliance use and, along with it, the potentialities for increasing the basic lighting and small appliance load.

Between February 1954 and January 1955 Detroit Edison had recording demand (15-min integrated) and watt-hour meters on the total and major-appliance loads in the homes of two customers in suburban Detroit. Kwhr use and maximum demands were compiled by months for range, clothes dryer, water heater, space heating, and miscellaneous appliances, and for total load.

Average weekday load curves for typical winter periods (Figs. 1 and 2) were drawn to picture the effect of the addition of major appliances to the basic lighting and miscellaneous appliance loads. Similar curves were made for summer days and patterns of appliance use compared.

Both dwellings are one-family, detached units built during the past five years and occupied by owners in the upper-income level. Residence A, occupied by four people, is a five-room ranch type with a full five-room basement. Residence B, which houses a family of five, has seven rooms, including a first-floor utility room. Both customers have radiant panel heating and, in addition to ranges, clothes dryers, and water heaters, a wide variety of smaller electrical appliances. Neither residence had either central or room air conditioning, although Residence A used an attic fan extensively during the summer. The connected load of each home was about 50 kw.

Annual use for all purposes at Residence A was 35,339 kwhr. The maximum demand (15-min integrated) recorded during the period was 21.4

kw, giving an annual load factor of 18.9%. On the average winter weekday (30-min integrated) the maximum demand was 12.43 kw, and the annual load factor increased to 32.5%.

For Residence B, the annual use was 32,877 kwhr, the maximum 15-min demand 16.4 kw, and the annual load factor 22.9%. The average winter weekday demand reached a peak of 9.84 kw. On this basis the annual load factor was 38.1%.

As was to be expected, space heating and water heating uses comprised the major portion of the total use. When these applications were excluded, total use was 6,826 kwhr for A and 7,241 kwhr for B. These figures contrast with an annual use of 2,700 kwhr for the average Detroit Edison residential customer.

Kwhr use, annual maximum and average winter weekday demands and load factors are analyzed by appliances in Table I. Average winter weekday demands were included primarily to show the magnitude of diversified demands expectable from a group of all-electric homes, in contrast with the 15-min peaks which were mostly non-recurrent and typical in nature.

On the basis of max annual demands, the addition of space heating and water heating loads resulted in an overall improvement in the annual load factor. On the basis of average winter weekday demands, however, the addition of these major loads resulted in a lower annual load factor.

Between Feb. 1, 1954 and Jan. 31, 1955, there were 6,081 degree days. Temperatures in both homes were maintained at 72F throughout each day and reduced at night. The basement heating units of A were used an average of only one day a week, and the other home has no basement. Data on space heated and heat loss are in Table II, and use of electricity for space heating in the two houses was as follows:

	Home A	*Home B*
Space Heating—Kwhr		
First floor	16,771	20,086
Basement	2,265	. . .
Kwhr/Deg-Day		
First floor	2.76	3.30
Basement	.37	. . .
Kwhr/Deg-Day/Kw Installed		
First floor	.27	.25
Basement	.06	. . .
Kwhr/DD/MCF Net Heated Space		
First floor	.28	.26
Basement	.04	. . .
Maximum Demand—Kw (15 min)	16.2	12.6
Annual Load Factor—Percent	13.4	18.2

Table I—Summary of Annual Kwhr Use

Annual Max Demands, Average Winter Weekday Max Demands and Annual Load Factors for Two All-Electric Homes

	Customer A					Customer B				
		Annual Maximum[1]		Winter Weekday[2]			Annual Maximum[1]		Winter Weekday[2]	
	Kwhr Use	Demand Kw	Load Factor	Demand Kw	Load Factor	Kwhr Use	Demand Kw	Load Factor	Demand Kw	Load Factor
Lighting, Small Appliances	4,130					3,563				
Water Heater-Upper Element	50					694				
Refrigerator	330					535				
Freezer	—					1,140				
Attic Fan	141					—				
Total Base Load	4,651	4.20	12.6%	1.12	47.3%	5,932	3.96	17.1%	1.34	50.5%
Electric Range	655	5.16	1.5	.60	12.5	656	5.10	1.5	.64	11.7
Clothes Dryer	1,570	5.16	3.5	1.08	16.6	1,347	4.80	3.2	1.08	14.3
Total	6,876	7.4	10.6	1.98	39.6	7,935	7.6	11.9	1.83	49.2
Space Heating	19,036	16.2	13.4	7.30	29.8	20,086	12.6	18.2	8.11	28.3
Total, as Billed	25,912	17.6	16.8	7.97	37.1	28,021	16.4	19.5	9.27	34.5
Water Heater-Lower Element	9,427	6.36	16.9	6.03	17.8	4,856	3.1(Est)	17.9	2.74	20.2
Total Load	35,339	21.4	18.9	12.43	32.5	32,877	16.4	22.9	9.84	38.1
Total, Excl. Space Heating	16,303	12.6	14.8	6.76	27.5	12,791	8.8	16.6	3.64	40.1

Average Winter Weekday Demands for Selected Periods[2]

	Customer A			Customer B		
	11:00 AM (Industrial Peak)	6:00 PM (System Peak)	7:00 PM (Residence Peak)	11:00 AM (Industrial Peak)	6:00 PM (System Peak)	7:00 PM (Residence Peak)
Appliance						
Lighting and Miscellaneous	.87	.78	.97	.64	.97	1.30
Electric Range	.07	.60	.20	.03	.05[3]	.16
Clothes Dryer	.34	.60	.60	.78	.04	.24
Space Heating	6.28	5.48	5.85	6.78	6.61	6.16
Water Heater-Lower Element	—	—	—	—	—	—
Total	7.56	7.46	7.62	8.23	7.67	7.86

[1] Maximum demand recorded during metered period, February 1954-January 1955 (15-Minute Integrated).
[2] Maximum demand on average winter weekday (January 17-28, 1955) (30-Minute Integrated).
[3] Electric range peak of .64 kilowatts occurred at 5:00 P.M.

These space heating ratios are in line with those obtained in more recent studies of this load for other well-insulated homes in the Detroit area.

Range use for the two customers amounted to around 650 kwhr annually. This corresponds to an annual range use of 1,100 kwhr for the average customer in the Detroit area, as derived from a 1949-50 study. Several factors account for this significantly lower figure:

1. Increased use of frozen and prepared foods since 1950 has reduced cooking time for a typical meal.

2. Greater use of automatic coffee makers, roasters, and grills has decreased range use.

3. There is a presumption that a higher proportion of meals are eaten away from home by upper-income groups.

Maximum range demands in excess of 5 kw were recorded by both customers. This figure represents 42% of the connected load of the range and gives an annual load factor of only 1.5%, compared to a 4.4% load factor for the average Detroit Edison range customer.

Clothes Dryer Use High

Both customers used significantly more electricity for drying clothes than did the average Detroit Edison customer as reported in a 1952 study. Residence A's clothes dryer use amounted to 1,570 kwhr, contrasting with an 818 kwhr use for an average family of four. The corresponding maximum demand (15-min integrated) was 5.16 kw, and the annual load factor 3.5%.

Residence B's clothes dryer use was 1,347 kwhr annually, with a maximum demand of 4.80 kw and a 3.2% load factor. In the 1952 study, average customer use for a family of five was 1,024 kwhr. Individual customer differences primarily accounted for the more recent large figures which reflect extensive summer use of the clothes dryer in both homes.

Water Heaters Up, Too

In both homes water heater use exceeded the 3,800-kwhr per year of the average Detroit Edison customer. At Residence A, two 80-gal water heaters operated simultaneously, the annual use being 9,427 kwhr for the off-peak period. This was lower-element use, served at a flat rate dependent on tank size, the charging period being limited to 10 hr between 10:00 and 6:00 P.M. There was also an estimated 50 kwhr of upper-element use during the year. Maximum demand for the two water heaters was 6.36 kw, and the annual load factor 16.9%.

Lower-element use for the 80-gal tank of customer B amounted to 4,856 kwhr, maximum demand being 3.1 kw. Extensive use of the upper element boosted total water-heater use by 694 kwhr. Upper-element demands are included with the lighting and miscellaneous-appliance demand in Table I.

For the year lighting and miscellaneous-appliance use was 4,651 kwhr for customer A and 5,932 kwhr for customer B. The 15-min integrated max demands were 4.2 and 4.0 kw, respectively. These figures, which include upper-element water heater, refrigerator, freezer, and attic fan use, exceeded the total use of the average Detroit Edison customer by 75% for customer A and 120% for customer B.

These figures underscore the extensive use of small appliances in these all-electric homes.

The dominant space-heating and water-heating loads far exceeded the lighting and miscellaneous use which was less than 20% of total use. Yet this load, range and clothes dryer use excluded, had an annual load factor near 50% (based on average winter weekday demands) and substantially exceeded use of the utility's average customer.

The load pattern of these all-electric homes point out not only the significance of major appliance use, but also the potentialities of increasing the size of the basic lighting and small appliance load. To Detroit Edison, at least, it looms as a great outlet for future sales.

Table II — Two Detroit Homes and their Appliances

Net Floor Area — Sq Ft	Customer A	Customer B
1st Floor	1,212	1,615
Basement	1,181	—
Total	2,393	1,615
Heated Space — Cu Ft		
Gross — 1st Floor	11,673	15,295
Basement	10,632	—
Total	22,305	15,295
Net — 1st Floor	9,696	12,516
Basement	8,858	—
Total	18,554	12,516
Calculated Heat Loss		
(BTU/Hr. — 10F to 70F)		
1st Floor	39,600	47,840
Basement	22,960	—
Total	62,560	47,840
Insulation	Complete	Complete
Windows	Storm Sash	Double Glass
Appliances — Connected Load (Kw)		
Space Heating — 1st Floor	10.3	13.3
Basement	5.85	—
Range	12.0	12.0
Clothes Dryer	4.5	4.5
Water Heater	12.0	6.0
Lighting and Misc. (Est.)	7.5*	10.0**
Total	52.1	45.8

*Includes: Vacuum cleaner, dishwasher, disposer, attic fan, two radios, refrigerator, television and automatic washer, iron, ironer and toaster.

**Includes: Vacuum cleaner, dishwasher, disposer, freezer, attic fan, blender, ventilating fan, two refrigerators, three radios, television, automatic washer, sewing machine, workshop equipment and a bookkeeping machine, two irons, ironer, and toaster.

COMPONENT LOADS

Room Coolers: SOS for Winter Load

- **Hot summers in nation's capital send peaks upward. Pepco's tests on air conditioners point need for winter balance**
- **Apartments run their units longer in daytime and use more energy than do private dwellings**
- **Maximum demands by two are about the same—around 1.1 kw; apartment coincident peaks came at 6 PM, private homes later in the evening**

H. F. G. MAIN, Rate Engineer, Potomac Electric Power Co, Washington, D. C.

Need for more winter load to complement mushrooming hot-month energy demands was made forcibly evident to Potomac Electric Power Co after load tests were conducted on window-type air conditioners last summer.

The heat was at a near record high and residents of the Washington, D.C. area acted accordingly. Energy use jumped as more room coolers went on the line. It gave Pepco an excellent opportunity to study air conditioner operating conditions at their maximum.

As the industry experiences more and more summer peaks, there would appear to be two means open for

Air Conditioner Demand on Selected Days of Test Period

Fig 1—Individual Residences

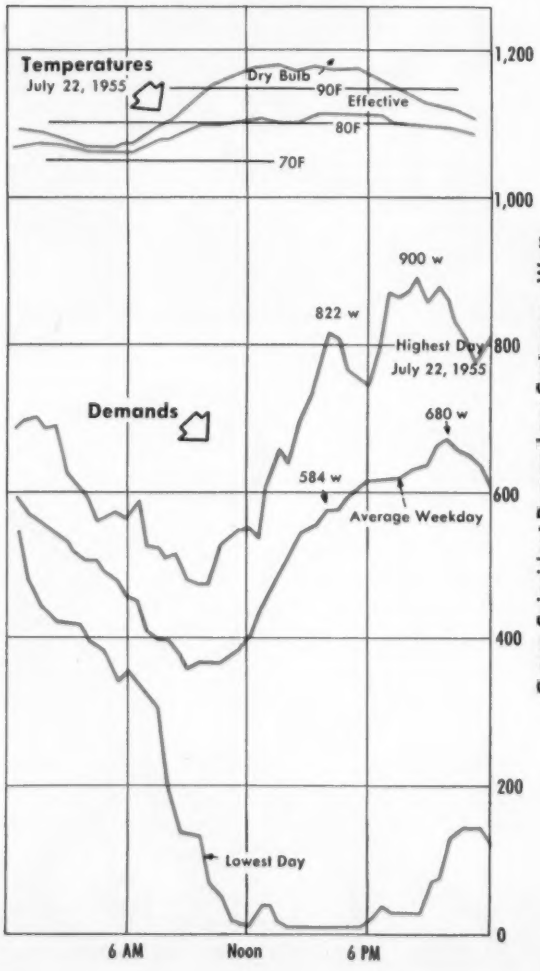
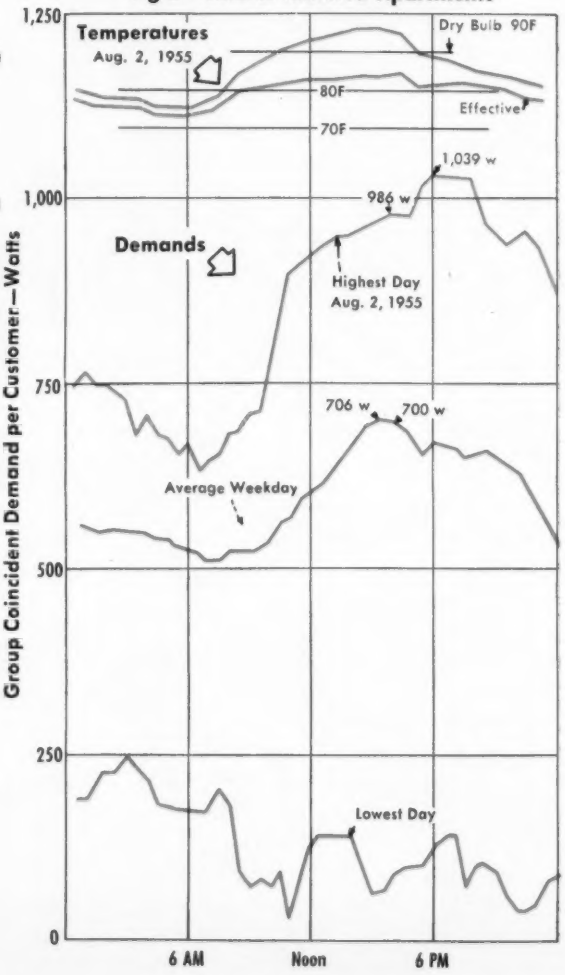


Fig 2—Master Metered Apartments



Group Coincident Demand per Customer—Watts

complementing the air conditioning load: (1) Promote space heating to balance the present cooling load, (2) Promote the heat pump for future cooling as much as is possible. Thus space heating would tend to balance the summer and winter loads, and the heat pump would tend to maintain the balance.

Two Separate Tests

Last summer's tests involved two separate studies, one of 31 single-family residences, the other of 31 master-metered apartments. In each case there was only one room cooler per dwelling unit. Energy consumptions and demands of the individual units were measured by test meters for two weeks or more. Here's what was observed:

The relationship found between cooling deg hours and energy consumptions, along with the load curves developed, show that room coolers are used significantly even when the effective temperature is below 71F. Usage at the lower temperatures appears to be greater in apartment units than in single-family homes and lends support to the notion that room coolers are used considerably for ventilation. Some of this usage, however, may be due to the heat lingering from the preceding day.

Heavier Apartment Use

The daily load curves, Fig 1 and 2, indicate a more prolonged daytime use in apartment units than in private homes. The tests pointed up a substantial increase in energy consumption in apartments over homes.

Some of this increase, of course, can be associated with lack of restraint inherent in master-metered dwellings. Nevertheless, the predominance of living room over bedroom location of the units and consequent increased daytime use may account for most of it.

In the Washington, D. C. area, within a range of 7,000 to 10,000 cooling deg-hours of effective temperature, energy consumptions of room coolers in single-family dwellings fall between 536 and 766 kwhr each season. Coolers in apartment dwellings may be expected to use 854 to 1,220 kwhr per season.

While individual customers' maximum demands in both types of dwellings are almost identical—1,115 and 1,118 w—the 1,039-w group coincident demand created by apartment coolers was 139 w higher than that of the coolers in homes. Moreover, the high value occurred at 6 PM, while the single-family house coolers peaked late in the evening.

Where system peak period is between 10 AM and 4 PM, the single-family house coolers impose less burden on the system than those in apartments. The peak-period coincident demand of the single-family house is 584 w on the average week day and 822 w on the max day. These figures contrast with the respective demands of 706 and 986 w created by coolers in apartments.

It was indicated that at least in the higher temperature regions demands tend to follow dry-bulb rather than effective temperatures. It also may be a result of thermostatic control of the cooler units by dry-bulb temperature. And the trend may increase with greater saturation of automatically controlled units.

The daily curves of dry-bulb and effective temperatures for the hottest day in each of the two test periods indicated that when the dry-bulb temperature hit 75 to 85F, humidity declined as a factor in the room cooler load as more emphasis was then placed on temperature alone.

Tests of single-family coolers were made July 17 through July 29, 1955, when humidity and temperatures in the 90's prevailed for ten of 13 days. Tests of room coolers in master-metered apartment dwellings were

Table I—Comparative Data from Unit Air Conditioner Tests

	Individual Residences	Master Metered Apartments
Average Rated Horsepower per Customer	.726	.712
Maximum Demand per Customer		
Non-Coincident	1 118 watts[1]	1 115 watts[2]
Coincident	900 watts[1]	1 039 watts[2]
Group Coincidence Factor	.805	.932
Group Diversity Factor	1.242	1.073
Energy Consumption per Customer		
Day of Max. Demand	16.6 kwhr	20.7 kwhr
Average Weekday	12.8 kwhr	14.2 kwhr
Per 100 Cooling Deg-Hr (Effective Temperature)	7.7 kwhr	12.2 kwhr
Average Month of July—Est.	235.0 kwhr[3]	372.0 kwhr[3]
Average Annual—Est.	654.0 kwhr[4]	1 037.0 kwhr[4]
Group Load Factor		
Based on Non-Coincident Max. Demand		
Day of Max. Demand	61.9%	77.4%
Average Weekday	47.7%	53.1%
Average Month of July—Est.	28.3%	44.8%
Average Annual—Est.	6.7%	10.6%
Based on Coincident Max. Demand		
Day of Max. Demand	76.8%	83.0%
Average Weekday	59.3%	56.9%
Average Month of July—Est.	35.1%	48.1%
Average Annual—Est.	8.3%	11.4%
Time of Occurrence of Coincident Max. Demand		
Day of Max. Demand	8:30 PM	6:00 PM
Average Weekday	10:00 PM	3:30 PM

NOTES:
[1] Based on group of 31 customers.
[2] Based on group of 26 customers.
[3] Projected on basis of 3,225 cooling deg-hr, effective temperature.
[4] Projected on basis of 9,000 cooling deg-hr, effective temperature per season of months of May through October, inclusive.

made Aug. 2 through Aug. 18, 1955. The first seven days had temperatures in the mid 90's. Hurricane Connie struck Aug. 12 and 13, and Hurricane Diane Aug. 17 and 18.

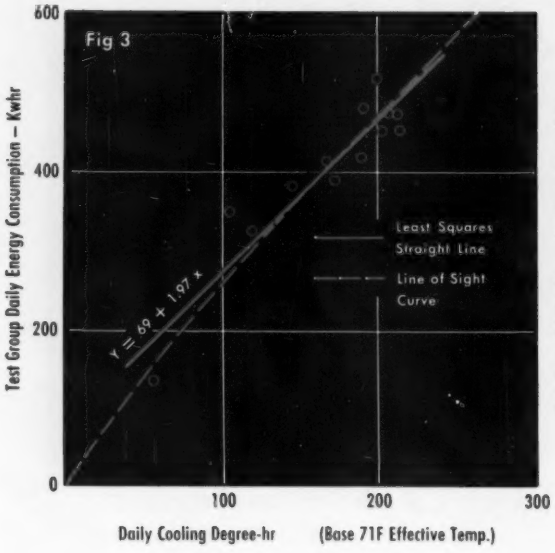
These storms caused system outages, so that some meter charts were stopped or knocked out of time. But a complete record was obtained of 19 of the 31 test customers through the entire test period. Observations made herein were derived from data for each day from as many customers as possible.

The single-family test customers were sampled at random from 1,211 customers known over an 18-month period to have only one cooling unit. A sample of 31 was drawn at random from a list of 1,522 apartment dwelling units known to be master metered and in which only one cooling unit was installed. Units under ½ hp were eliminated. In both types of dwellings, the bulk of cooling units were in the ¾-hp size. The bedroom was the most usual location in single-family dwellings. Apartment units favored the living room.

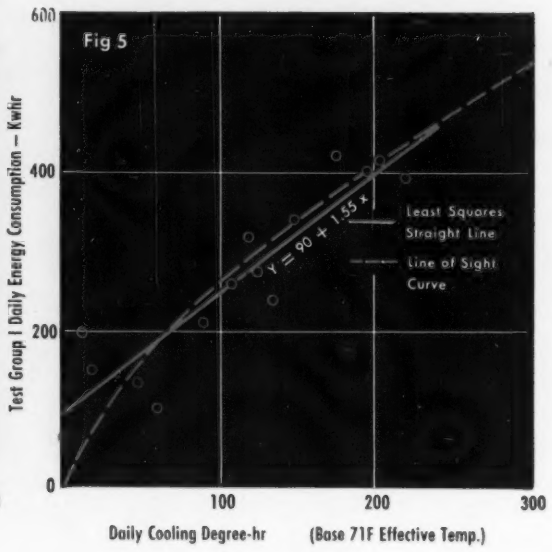
Energy consumptions and half-

Relationship Between Energy Consumption and Cooling Degree-Hours

INDIVIDUAL RESIDENCES

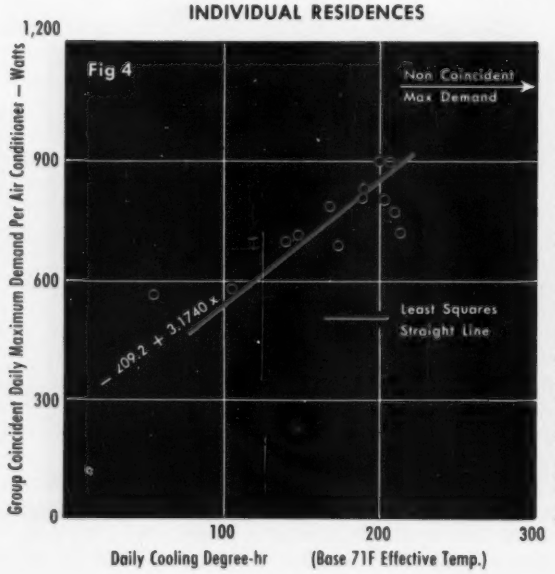


MASTER METERED APARTMENTS

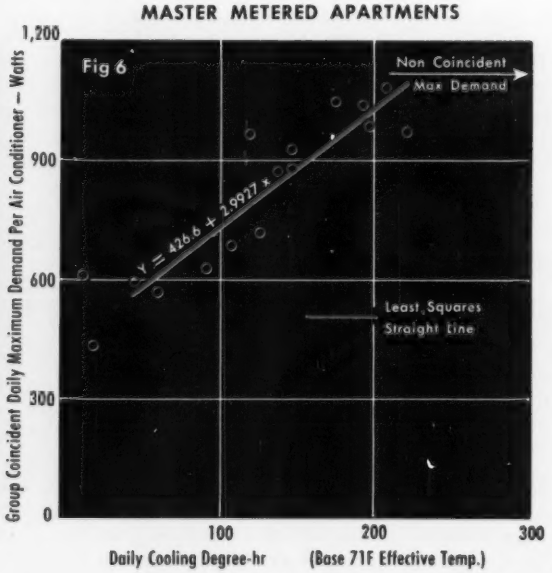


Relationship Between Coincident Demand and Cooling Degree-Hours

INDIVIDUAL RESIDENCES



MASTER METERED APARTMENTS



hourly demands were recorded and processed to obtain average data per customer for max peak days and average week days. Dry and wet bulb temperatures were recorded to obtain effective temperatures and deg-hours of effective temperature (base 71F). Other weather conditions also were recorded.

Average energy consumption and maximum and coincident demands per customer shaped like this:

	Homes	Apartments
Kwhr per day	13.02	14.36
Max demand watts	1,118	1,115
Coincident demand, watts	900	1,039
Coincidence factor	.805	.932

The maximum coincident demand of the single-family dwelling group occurred consistently in the evening. On individual days this peak was frequently at 10 PM, as early as 6PM, and as late as 11:30 PM. The highest of the test period was at 8:30 PM. The maximum coincident demand of the apartment group occurred at 3:30 PM on the composite average weekday. On individual weekdays it was as early as 2:30 PM and as late as 10 PM. It was highest at 6 PM.

The effect of one room cooler in a single family house or an apartment on the Pepco system, with its summer daytime peak is most peculiar. For example, if 10,000 units are added, the residential load factor would increase by about 0.5% because of the class peak occurring in winter; whereas the system load factor would decrease by about 0.5%. Thus it is apparent that additional winter load is required to complement the effect of adding large numbers of room coolers to the system.

Fig 7—Comparative Load Curves

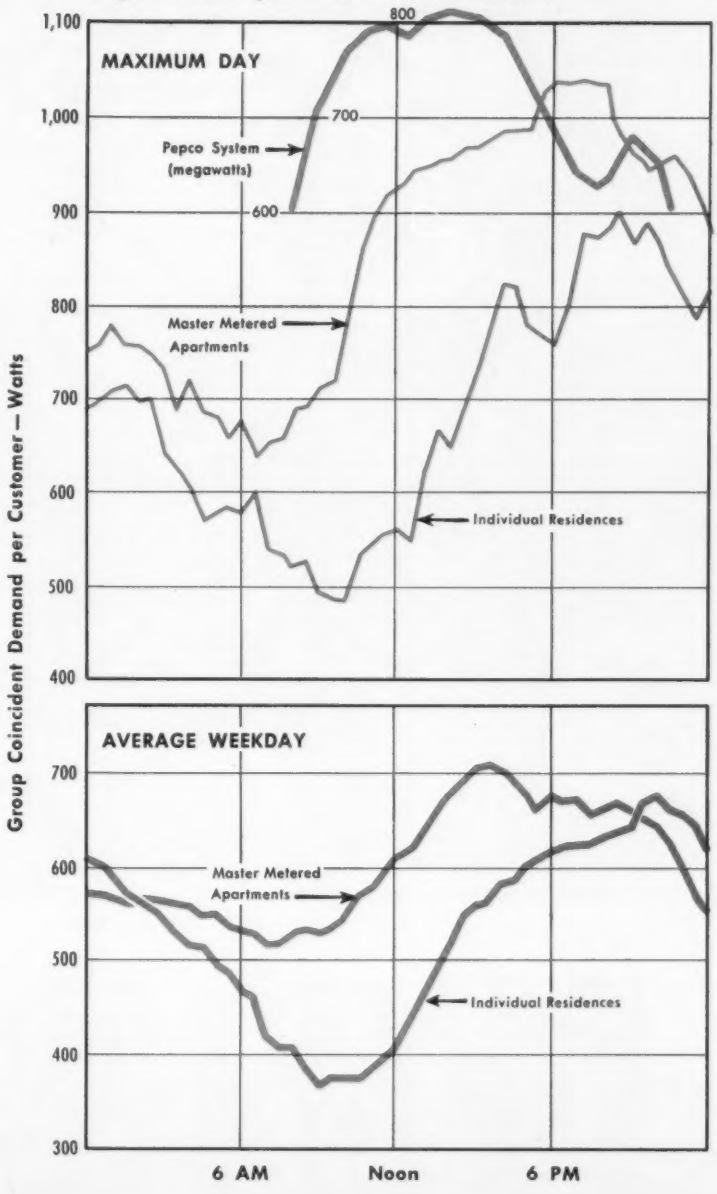


Table II—Approximate Annual Energy Use of Typical Room Coolers

(Estimated in kwhr from test data)

Individual Residences	Cool Summer[1]	Average Summer[2]	Hot Summer[3]	Master Metered Apartments	Cool Summer[1]	Average Summer[2]	Hot Summer[3]
½ Hp	425	525	600	½ Hp	700	850	1 000
¾ Hp	550	675	800	¾ Hp	900	1 100	1 300
1 Hp	675	825	975	1 Hp	1 100	1 350	1 600

[1] Based on 7,000 cooling deg-hr, effective temperature—base 71F
[2] Based on 8,500 cooling deg-hr, effective temperature—base 71F
[3] Based on 9,000 cooling deg-hr, effective temperature—base 71F

Space Heating: What Happens in the 6,000 Degree-Day Zone?

Energy consumptions of 12,500 kwhr per customer, demands of 6.9 kw, and load factors of 20.5% are shown by Detroit Edison

Detroit Edison Co is keeping a watchful eye on its steadily growing electric house heating load.

In spite of 6,000 deg-day weather in the area, the company now serves over 300 . . . electrically heated homes. And it looks for consumer demand to accelerate in the years ahead.

Most of its investigation is in the form of load studies. Every year since the 1949-50 heating season Detroit Edison has metered groups of its electric heating customers.

Conclusions so far emphasize two major problems. From the consumer standpoint it is largely one of operating cost. From the company view, it says, the cost of serving a load with high individual and group demands and a poor annual load factor must be reconciled with revenues to be derived. Determining the overall cost to serve the space heating load should be a primary consideration, it feels—both as a guide to promotional policy and with an eye to possible rate changes.

Latest report available is for the 1953-54 season when the company placed kwhr meters and Type G integrating demand meters in 35 customers' homes. Most of the installations were radiant panels. These are the findings:

1. Individual customer use and demands showed wide variance, even when adjusted for size of dwelling, insulation, and installed capacity of heating units. In general, dwelling units were of one or 1½ story construction and fully insulated. Sizes ranged from 494 to 2,026 sq ft of floor space. Heat loss varied from 20,460 to 82,560 Btu per hr, based on design temperatures of −10F (outdoor) and 70F (indoor).

2. Space heating use comprised more than 75% of the total metered use of these customers. Individual use for the season varied from 4,534 to 25,475 kwhr, with an average of 11,234. Seasonal degree days from Sept. 1, 1953, to May 31, 1954, were 5,749. Adjusted to a normal heating season (6,396 deg-days), the average annual use would be more like 12,500 kwhr, and annual cost would run $270 per average customer.

Fig 1—Relationship Between Daily Degree Days and Daily Energy Use

Fig 2—Relationship Between Daily Coincident Maximum Demand and Temperature

Average of 35 Customers

(Based on Data for 39 Selected Days 1953-54 Heating Season)

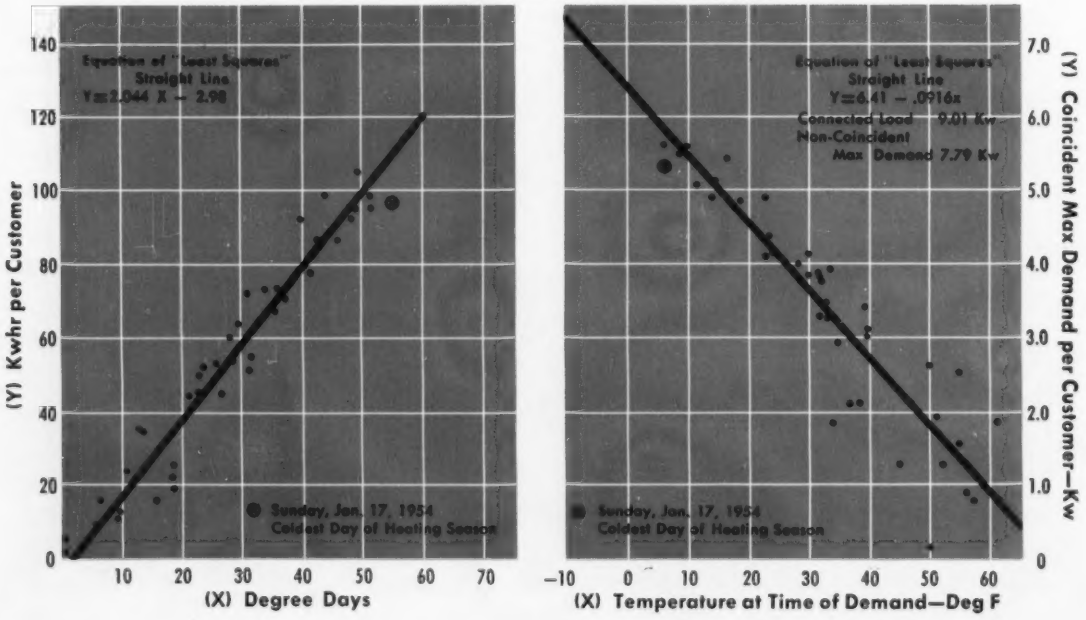


Table I—Average Customer Load Characteristics

Residential Electric Space Heating—1953-54 Heating Season

Number of Customers in Test	35
Average Number of Rooms per Residence	5.17
Net Floor Area—Sq Ft	965
Heated Space per Customer, Cu Ft	
Gross (Outside measurements)	9,496
Net	7,568
Calculated Hourly Heat Loss per Customer-Btu per Hr	37,630
Temperature Basis—F, Outdoor	−10
Temperature Basis—F, Indoor	70
Rated Capacity of Heating Panels per Customer, Kw	9.01
Annual Energy Use, Kwhr	
Space Heating	11,234
Other	3,281
Total (As billed)	14,515
Deg Days—65F Base (9-1-53 to 5-31-54)	5,749
Maximum Demands per Customer, Kw (Integrated clock half-hour)	
Coincident Max Demand	5.63
Date	2-12-54
Day and Time	Friday, 8:30 AM
Outdoor Temperature, F	7
Non-Coincident Max Demand	7.79
Load Factors, Annual, Per Cent	
Based on Coincident Max Demand	22.7
Based on Non-Coincident Max Demand	17.0
Coincidence Factor, Per Cent	72.3
Demand Factor, Per Cent (Ratio of non-coincident max demand to rated capacity)	87.8
Ratio of Rated Capacity in Equivalent Btu to Calculated Hourly Heat Loss in Btu, Per Cent	81.9
Annual Energy Use Ratios, Kwhr	
Per Degree-Day	1.94
Per Degree-Day per Kw of Rated Capacity	.229
Per Degree-Day per mcf of Heated Space	
Gross	.201
Net	.268
Per Degree-Day per M Btu Calculated Heat Loss per Degree Difference in Design Indoor and Outdoor Temperature (80 F). This factor is the reciprocal of the "Experience Factor" for an individual customer, expressed in 1,000 Btu.	4.26
Actual Experience Factor for FHA Formula	270
Estimated Normal Heating Season Use, Kwhr	12,472
Normal Deg-Days	6,396
Estimated Coincident Max Demand on Day with Temperature Equal to Outdoor Design Temperature, Kw	6.92
Annual Group Load Factor based on Normal Season Use and Estimated Max Coincident Demand at Outdoor Design Temperature, Per Cent	20.5

Note: All ratios are the average for the 35 customers.

3. Kwhr per deg-day per kw of installed capacity varied from 0.11 to 0.45 with an average of 0.229. Bulk of the customers (85.7%) fell between 0.11 and 0.30.

4. Kwhr use per deg-day, adjusted for the space heated, showed a similar range. It averaged 0.268 kwhr per deg-day per 1,000 cu ft of net heated space. Values ranged from 0.13 to 0.55 kwhr. On the sq ft basis, use per degree-day averaged near 12 kwhr, with extremes of 6 and 25 kwhr.

5. A mean value of 4.26 was reported for the "kwhr use per deg-day per 1,000 Btu of calculated heat loss per deg difference of indoor and outdoor design temperature" factor. Variation between 1.99 and 8.94 was recorded. Average of the "experience factor" (or "K" factor as the Federal Housing Administration calls it) was 270 for the 35 customers as compared with FHA's nominal value of 200.

6. Customer's installed capacity averaged 9.01 kw. Ratio (in Btu per hr) to the calculated hourly heat loss was 81.9%.

7. Non-coincident max demand per customer was 7.79 kw, or 87% of rated capacity. Annual load factor, based on non-coincident max demands, averaged 17%. Individual load factors were as low as 8.3% and as high as 33% for one customer. Most of them fell in the 10% to 20% range —as favorable as those experienced by most high-use customers.

8. Group max demand of 5.63 kw per customer came at 8:30 AM, Friday, Feb. 12, when the temperature reached a low of 7F. Based on this demand, the coincidence factor was 72.3%, and the resultant annual group load factor 22.7%.

9. Fig 1 shows the relationship between daily deg days and daily energy use, Fig 2 between daily coincident max demand and temperature. Data were computed for 39 selected days with varying temperature and weather conditions.

Because there were no days in the 1953-54 heating season when temperature fell below −6F, it was estimated that a coincident max demand of 6.9 kw would be expected if the temperature had reached −10F, the normal min design temperature.

This estimate is 0.4 kw lower than that shown in Fig 2. But with existence of a number of undersized units and the possibility of vacations during the winter peak period, the 6.9-kw value does not appear unreasonable. With normal season heating use of 12,500 kwhr per customer and the estimated demand of 6.9 kw, the annual load factor would be 20.5%.

A summary of these conclusions is listed in Table I.

COMPONENT LOADS

Heat Pumps: What Nine Homes Show

- **They are heated and cooled for average $367 a year in study made by Union Electric Co of Missouri**
- **Use averages 18,750 kwhr; annual load factor runs 30%**

A thorough study of nine homes equipped with heat pumps was conducted in its service area by Union Electric Co of Missouri during the 1953 cooling season and the 1953-54 heating season. As given in Table I, these data suggest some facts interesting to utilities considering the promotion of the all-electric home.

Although the non-coincident maximum demand per customer amounted to 10.93 kw during the heating period, the coincident maximum demand per customer was only 7.98 kw. These values give a coincident factor of 73%. During the cooling season the non-coincident maximum demand per customer fell to 7.43 kw and coincident demand to 6.85 kw, affording a coincident factor of 92.2%.

Economic incentive for promoting the heat pump is intimated by the attractive annual load factor for the year, 30%, based on the coincident maximum kw demand and the kwhr consumption for the heating and cooling seasons.

From the customer's point of view, it is noteworthy that his home can be heated at about $17 and cooled at about $7 per thousand cu ft per year. Actual consumption for the cooling season turned out to be as estimated, both figures being 6,000 kwhr. The heating season's actual consumption, on the other hand, was 12,750 kwhr instead of the estimated 14,950 kwhr.

Three completely electric homes having heat pumps in the St. Louis service area were also studied more recently by Union Electric. These particular homes were selected because their kwhr consumption fell on both sides of the average consumption of a large number of homes equipped with heat pumps.

They showed, in general, that energy consumption varies with size of the house, as does the max demand for heating and cooling. The load factor (based on max demand for the year) was highest for the largest house. It fell at 21.7%. Load factor for the smallest was 14.1%. It appears load factor doesn't necessarily vary in direct proportion to the cubic content of the house.

Here are the three homes' annual kwhr consumptions broken down by use:

	Home 1	Home 2	Home 3
Water Heating	5,066	1,794	4,676
Heating	14,430	7,180	15,990
Cooling	7,600	950	7,770
Other Uses	6,504	3,046	4,478
Total	33,600	12,970	32,914
Load Factor	19.4%	14.1%	21.7%

Building volume for Home 1 is 16,460 cu ft, for Home 2, 10,870 cu ft, and for Home 3, 20,870 cu ft. For heating, kwhr per degree-day for thousand cu ft. averaged 0.214 for Home 1, 0.161 for Home 2 and .249 for Home 3. For cooling, kwhr per deg-hr for thousand cu ft averaged .022, 0.004 and 0.025 respectively.

There were 4,091 deg-days in the St. Louis area during the heating season and 20,754 deg-hrs during the cooling season. Besides heat pump and water heater, each home had a range and refrigerator among its major appliances.

Table I—Heat Pumps in Nine Homes
1953 Cooling Season and 1953-54 Heating Season

	Htg Season	Cool Season	Annual Period
Non-Coincident Max Kw Demand per Customer	10.93	7.43	10.96
Coincident Max Kw Demand per Customer	7.98	6.85	7.98
Date	1/12/54	8/1/53	1/12/54
Time	9:00 AM	1:30 PM	9:00 AM
Coincidence Factor (Based on above demands), %	73.0	92.2	72.8
Non-Coin Max Kw Dem/Cust/M Btu/Hr Heat Loss	.129	–	–
Non-Coin Max Kw Dem/Cust/M Btu/Hr Heat Gain	–	.207	–
Kwhr per Customer, Actual	12,750	6,000	18,750
Kwhr per Customer for Normal Heating Season, Est	14,950	6,000	20,950
Kwhr/DD/MCF	.217	–	–
Kwhr/M Btu/Hr Calculated Heat Loss (Normal season)	176	–	–
Kwhr/M Btu/Hr Calculated Heat Gain	–	167	–
Kwhr/M Btu/Hr Calculated Heat Loss plus Heat Gain			172
Operating Cost for Normal Heating & Actual Cooling Season			
Total @ 1.75¢/Kwhr,	$262	$105	$367
Per MCF (With given heat loss and heat gain),	$ 17	$ 7	$ 24
Per M Btu/Hr Heat Loss,	$ 3	–	–
Per M Btu/Hr Heat Gain,	–	$ 3	–
Per M Btu/Hr Heat Loss Plus Heat Gain,	–	–	$ 3
Annual Load Factor,			
Based on Coincident Max Kw Dem and Actual Kwhr,	18.2%	10.0%	26.8%
Based on Coin Max Kw Dem and Kwhr for Normal Heating Season and Actual Cooling Season	21.4%	10.0%	30.0%
Based on Non-Coin Max Kw Dem and Kwhr for Normal Heating Season and Actual Cooling Season	15.6%	9.2%	21.8%

Water Heaters: A Hot Topic

- **Means of selling and serving them have long been a subject of utility debate, planning, and research**

Two companies give their reports:

- **On quick recovery—Detroit Edison likes its competitive advantages**
- **On uncontrolled units—Southern Services gives them an okeh**

Preliminary test results incline Detroit Edison Co to favor promotion of a high-wattage, quick-recovery type water heater as the competitive, electrical substitute for gas.

On the basis of the first findings, the heater's high coincident demand made this load appear undesirable to the company on anything but its residential rate for other unrestricted uses. But continuing study of controlled operation of these quick-recovery units is expected to yield an alternative rate which may afford it with the competitive advantages of an appliance with lower cost and greater speed.

Table I — Comparative Operating Characteristics
(3 Major Appliances)

	Range	Clothes Dryer	High Wattage Water Heater
Connected Load, kw	10.1	4.56	4.5
Non-Coincident Max Demand, kw	3.06	4.21	4.43
Coincident Max Demand, kw	.83	.96	2.62
Coincidence Factor, %	27.1	22.8	59.2
Time of Peak Demand	6 P.M.	11:30 A.M.	10:30 A.M.
Average Use per Day, kwhr	3.52	2.62	20.5
Load Factor, %	17.7	11.4	32.6

Year-long Tests Made

Recent prominence given the competitive possibilities of the high-wattage heater prompted Detroit Edison to evaluate it from its own and its customer's viewpoints. Year-long tests were made on 90 heaters of 40 and 50-gal capacities, equipped with two interlocked heating elements of 4.5 kw. These were placed in the homes of company employees and others who, for the most part, had not previously owned electric water heaters.

Monthly Records Tape

Operation was divided between uncontrolled and controlled, the latter by means of a time switch restricting operation to off-peak periods. Monthly records of hot water and electricity use were obtained. Demand data for both upper and lower elements, as well as for the pattern of hot water use, were taken during three two-week periods. Begun in March, 1955, the tests now are being compiled in report form and the results analyzed.

Currently available, however, are its first findings—data on kwhr use, demand, and temperature gathered from 43 customers during one week of controlled operation.

Besides the high coincident demand mentioned above, this first study also disclosed several other points of significance:

1. High-wattage electric water heaters supply an adequate amount of hot water for most requirements.

2. They will bring increased kwhr use. The value of the increased load to the company depends not only on the rate schedule adopted to serve it, but also on how much added capacity may be required.

3. The diversity of operation between high recovery units is not sufficiently great to offset the high connected load.

Only a Preliminary

Detroit Edison is quick to point out that the test was only a preliminary to the one now being compiled and the information is not necessarily conclusive. It does, however, feel that it is indicative of the quick recovery heater's use characteristics.

The sample of 43 customers in this first test was metered for two months, and the associated coincident demand data was obtained by combining corresponding days of the week. Relevant characteristics of these 43 loads were as follows:

Average family size	3.88
Type Washer	
Automatic	41
Non-Automatic	2
Kwhr Use per Day (Water Heater Use Excluded)	13.5

Of particular significance is the high saturation of automatic washers and the higher-than-average daily use of electricity. Further data is being compiled from customer interviews.

Results of the initial metering, based on combined upper and lower element kwhr use and demands, stress three primary factors:

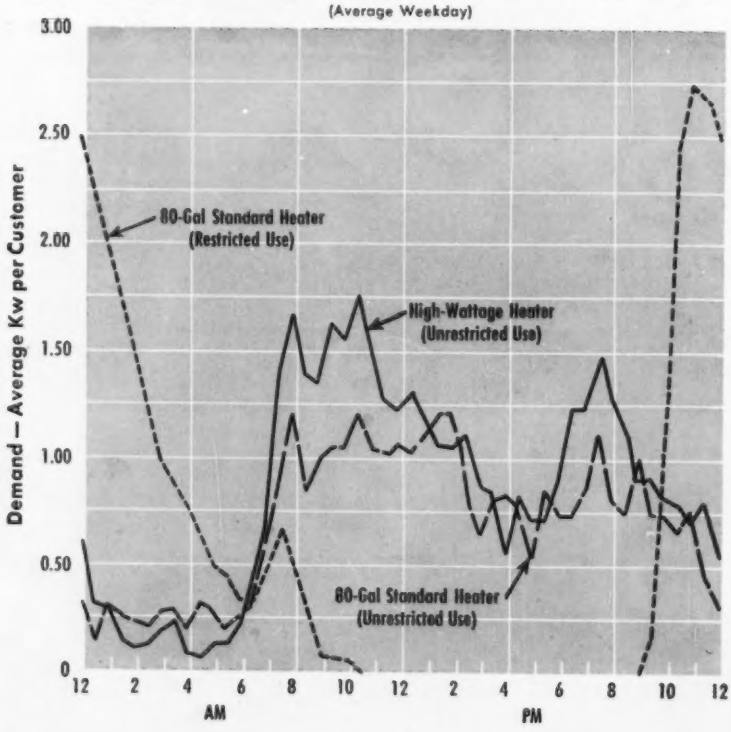
1. Kwhr use with unrestricted operation of the high-recovery units shows a significant increase over controlled operation of the standard water heaters now in use in the area.*

* Standard water heaters in Detroit Edison territory are heated by two elements of equal size—2,500 w each for 50 and 60-gal heaters, and 3,000 w each for 80-gal heaters, etc. Upper element use is controlled by a switch that may be turned on at the customer's discretion. Use is billed at regular residence rates, and for the average customer there is no significant use of the upper element. Lower element use is controlled by a time switch restricting operation to the "valley" hours, a 10-hr period beginning at intervals between 9 and 11 P.M. Use is billed at a flat rate, dependent on tank size.

Table II — Comparison of High-Wattage and Standard Water Heaters

	Standard 80 Gal		High Wattage (40-50 Gal)
	Restricted	Unrestricted	
Number in Sample	13	13	43
Average Family Size	4.4	4.4	3.88
Connected Load, Kw			
Lower Element	3.0	3.0	4.5
Upper Element	3.0	3.0	4.5
Kwhr Use per Customer			
Average Weekday	14.5	17.1	20.5
High Use Day	15.3	19.8	23.4
Max Demand, Kw			
Non-Coincident	2.90	2.86	4.43
Coincident			
Max for Test Period	2.78	1.98	2.63
Average Weekday	2.74	1.21	1.75
Average Weekday Demand			
At Time of Industrial Peak (10:30 AM)	—	1.19	1.75
At Time of System Peak (6 PM)	—	.76	.89
At Time of Residential Peak (7 PM)	—	.87	1.23
Load Factor, Per Cent			
Average Weekday	21.2	58.7	48.7
Coincidence Factor, Per Cent (Based on Test Week Maximum)	95.9	69.2	59.2

Fig 1 — Comparison of High-Wattage and Standard Water Heaters



Average weekday use for the 43 tested customers was 20.5 kwhr, compared to 10.4 kwhr for the average Detroit Edison water heater customer. Part of the increase is attributable to the high saturation of automatic washers in the test group, although the availability of hot water must be considered an important factor in the increased water use.

2. Max demand for the test week was 2.62 kw, compared to the present estimated demand per customer of 2 kw for a standard Detroit Edison water heater. Group max demand per customer for the high-wattage unit is more than 2½ times the maximum demand of 1.05 kw for a sample of customers using standard water heaters on an unrestricted basis. Here again the change in customer characteristics and the inability of standard water heaters to supply sufficient hot water are contributing, if not controlling, factors in the increase.

Higher Demand, Load Factor

The high-wattage water heater has a substantially higher coincidence factor, maximum demand, and load factor than other major appliances.

How it compares in these respects with ranges and clothes dryers, as determined by previous Detroit Edison studies, is shown in Table I.

3. Of significance is the 10:30 AM peak. As this is the time of the industrial peak on the Detroit Edison system, the addition of a number of high-wattage water heaters to the daily load pattern would create a substantial increase in the morning peak. Furthermore the pattern of use established by the sample group indicates that the high-wattage heaters operating on an unrestricted basis would add significantly to the system peak at 6 PM (0.89 kw per heater) and to the residential class peak at 7 PM (1.23 kw for an average weekday).

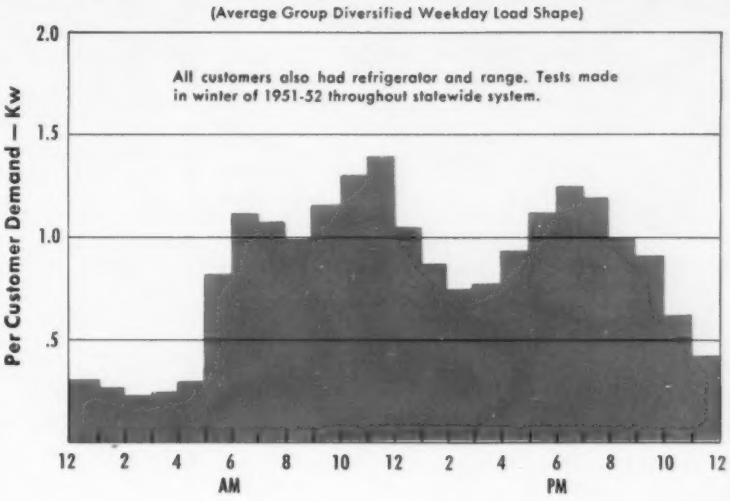
Upper Element Use Small

Total load is of prime significance in evaluating the load's effect on the utility system. Upper and lower element use and demand data are given as a measure of the adequacy of the quick-recovery water heater from a customers' standpoint. Of the 43 customers, only six had upper element use in excess of 1 kwhr per day. Yet records show water temperatures fell below 140F less than once per week per customer.

Most customers in the present survey did not have standard Detroit Edison water heaters previously. Thus no direct comparison can be made in the use pattern of standard and high-wattage heaters. But a summary of the findings of this preliminary report and the results of an earlier study on the controlled and uncontrolled operation of standard water heaters appears as Table II.

To eliminate adequacy of water as a major factor in increasing average customer use, high-wattage water heater results are compared with those of a standard 80-gal tank. From the data given, average use for the high-wattage tank was nearly 20% above the standard water heater use, and peak demand increased 45%. Of equal significance is an increase in load with unrestricted operation of near 50% at the time of the residential peak, 7:00 PM, and reduction in loads during the late evening and early morning. (Fig 1.)

Fig 2 — 88 Customers with ASA Uncontrolled Water Heaters


(Average Group Diversified Weekday Load Shape)
All customers also had refrigerator and range. Tests made in winter of 1951-52 throughout statewide system.
Per Customer Demand — Kw
2.0
1.5
1.0
.5
12 2 4 6 8 10 12 2 4 6 8 10 12
AM
PM

Controlled vs Uncontrolled

In another study, Southern Services Inc set out to find the impact of uncontrolled water heating on properties of its parent Southern Co. The result: Water heating today goes without control in all of the Southern Co systems (Alabama, Georgia, Mississippi and Gulf Power Cos').

The tests were made in the winter of 1951-52 among 88 customers in Alabama and Georgia. Units were built to American Standards Association and American Society of Mechanical Engineers' specifications. Connected load ranged from 1 to 5 kw depending on tank sizes which varied from 30 to 120 gal. Most of the heaters had twin heating elements interlocked. The test group was selected on the basis of kwhr use—to correspond as closely as possible with what Southern Co had found to be the norm for its residential class of customers. Each tested customer had a range and refrigerator besides a water heater.

Operating data gleaned from the studies is shown in Table III, diversified winter weekday load shape in Fig. 2.

Southern Services is now turning its attention to the quick recovery unit. Results of a series of tests are yet to come, but in the meantime, Southern Co permits their connection on its lines.

• • •

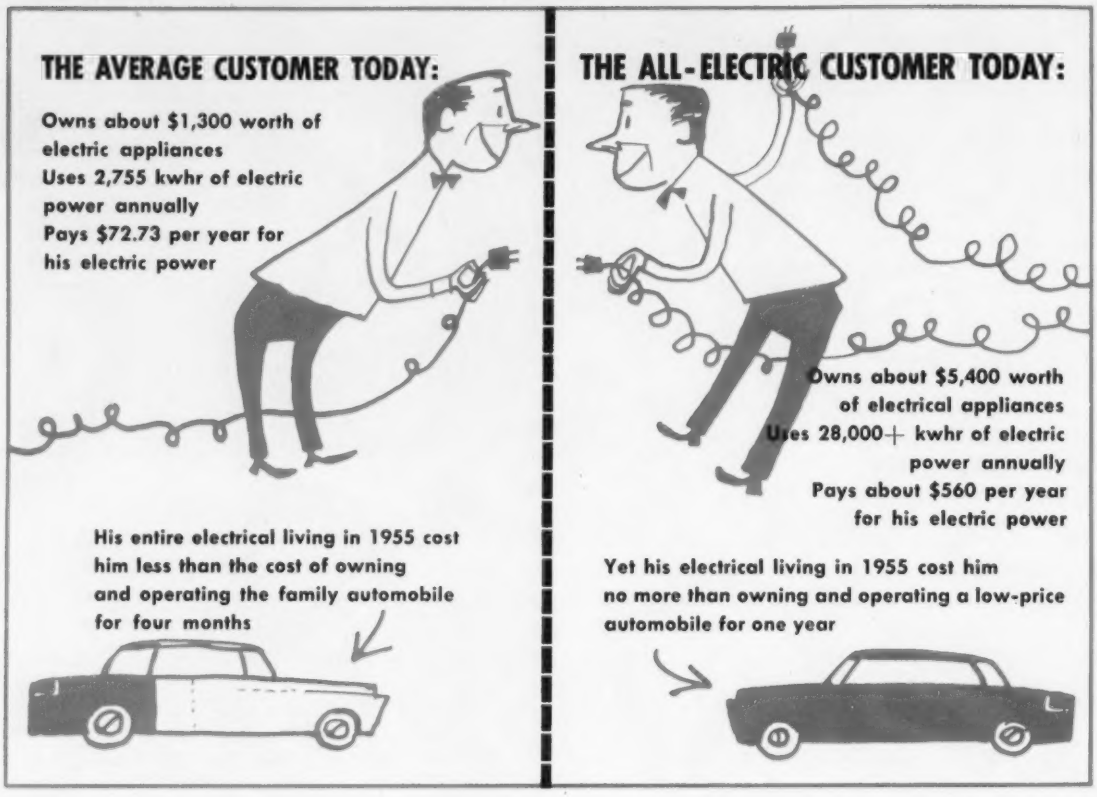
And so the search to put the water heater over the sales hump goes on. Today some 22% of the nation's utilities permit installation of high-wattage QR units on their lines. And manufacturers are optimistic the unit will continue gaining ground.

But as one water heater maker put it: "Whatever happens, something's got to give. Electric water heating sales have got to get off the ground soon, or we've got to get out of the business."

Table III — Operating Characteristics: Total Load of Customers with Uncontrolled ASA Water Heating
(Southern Services, Inc)

Number of Customers Tested*	88	Per Cent Load Factor (Based on Avg Weekday Coincident Demand)	60
Test Period	Winter		
Date	1951-52	Avg Monthly Consumption, Kwhr (7 days of Test Week x 4⅓)	589
Length of Tests per Customer, Days	7		
Energy Use per Customer—Avg Weekday, Kwhr	20.15	Coincidence Factor, %	31.5
Non-Coincident Max Demand Per Customer, Kw	4.45	Monthly Load Factors:	
Average Weekday Demand per Customer:		Based on Max Group Diversified Demand for Avg Weekday, %	57.5
Max Hr, Kw	1.40	Based on Residential Winter Peak Hr (6-7 PM), %	63.5
5-6 PM, Kw	1.14	Based on System Winter Peak Hr (5-6 PM), %	70.8
6-7 PM, Kw	1.27	Max 30-Min Individual Customer's Demand in Group, Kw	7.68

*Each customer also had electric range, refrigerator, lighting, and other miscellaneous appliances.


THE AVERAGE CUSTOMER TODAY:
Owns about $1,300 worth of electric appliances
Uses 2,755 kwhr of electric power annually
Pays $72.73 per year for his electric power
His entire electrical living in 1955 cost him less than the cost of owning and operating the family automobile for four months
THE ALL-ELECTRIC CUSTOMER TODAY:
Owns about $5,400 worth of electrical appliances
Uses 28,000+ kwhr of electric power annually
Pays about $560 per year for his electric power
Yet his electrical living in 1955 cost him no more than owning and operating a low-price automobile for one year

Who Can Buy the All-Electric Home?

More people than you might think. But so far they're putting their money into other things

Marketwise, the all-electric home is not out of reach.

As the charts above show, the family who enjoys electrical living to the fullest pays little if anything more than it does to own and operate a low-priced automobile.

Not that a family would be expected to give up its car. The significance of this comparison lies in the number of families who own not one, but two or more cars.

This year, if they run true to past form, 600,000 to 700,000 American households will acquire another auto in addition to whatever they now have. A whopping 4.8 million already do have more than one.

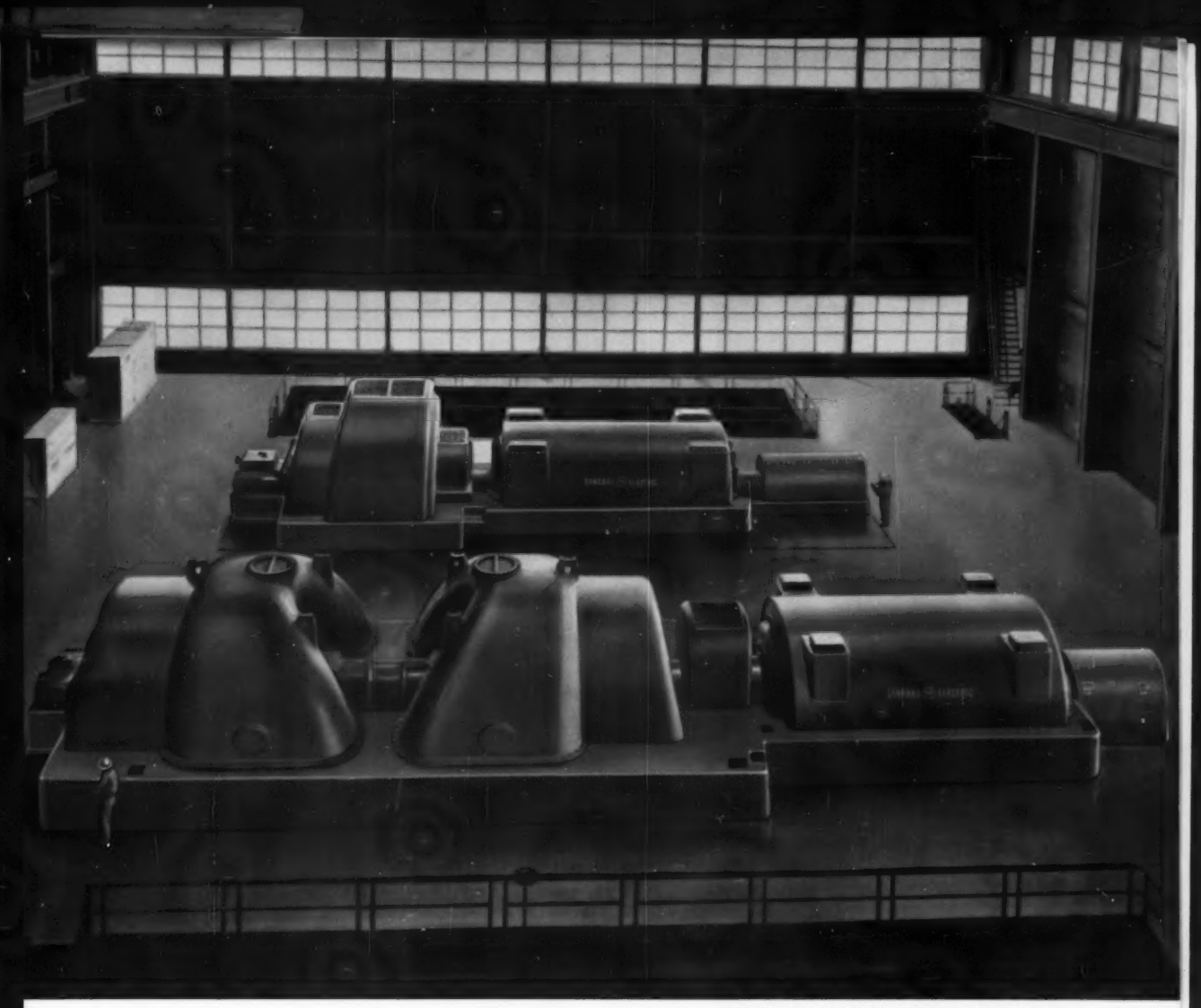
These buyers properly represent a ripe market for the all-electric home —people with the means to engage in above-average discretionary spending.

But the market is not being even scratched. Using heating as the basis, there are approximately 305,000 homes in the nation today which reasonably could be called all-electric. About 300,000 have resistance heaters, 5,000 have heat pumps. Consider those that have comfort cooling (apart from those with heat pumps) and the number becomes smaller.

This year a possible 30,000 more all-electric homes will be added—25,000 with resistance heating, another 5,500 with heat pumps. Small potatoes when contrasted with the 1.1 to 1.3 million total housing starts each year.

One executive estimates the industry could foster 100,000 or more all-electric homes this year if it wanted to. When you pit this against the market potential of just one segment —the multi-car family—it doesn't appear unreasonable.

As Philip Sporn, American Gas & Electric Co president and long-time champion of the cause, said at last year's Edison Electric Institute Sales Conference: "It is astonishing how much excitement and interest is created whenever a well-designed all-electric home is exhibited. All-electric homes can be and are being sold. And the utilities have the capacity and the technical means to serve them profitably. The fact that the market potentials were not visualized 10 or 20 years ago ought to act as additional stimulus and incentive to get the load now."



CONSULTING ENGINEERS: SARGENT AND LUNDY

G-E progress in cross-compound design offers

MORE ECONOMY FOR TODAY'S HIGHER RATINGS

Keeping pace with today's demands for higher ratings and greater efficiencies are General Electric developments in cross-compound turbine-generator design. This design separates high- and low-pressure sections, permitting greater efficiency in each. Latest G-E cross-compound designs offer better economies than ever before obtainable.

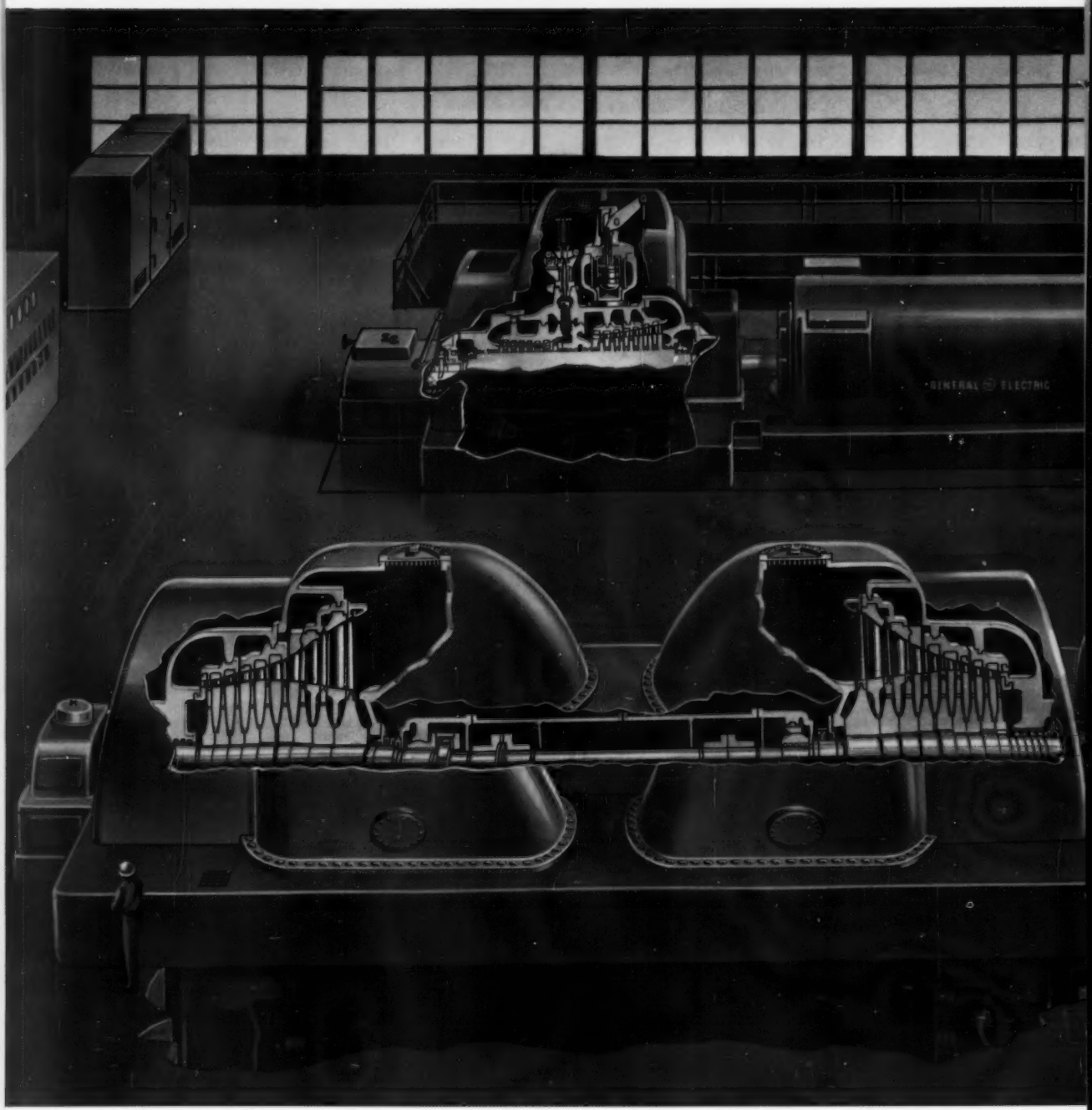
An application of this design is Unit No. 2 (above), now in operation in the Will County Station of the Public Service Company Division, Commonwealth Edison Company. Located near Chicago, the Will County Station is an important power producer for Northern Illinois.

This installation typifies the vigorous efforts being made by progressive electric utility companies to expand and improve the efficiency of their power generation systems to provide adequate low-cost electricity for increasing loads.

Progress Is Our Most Important Product

GENERAL ELECTRIC

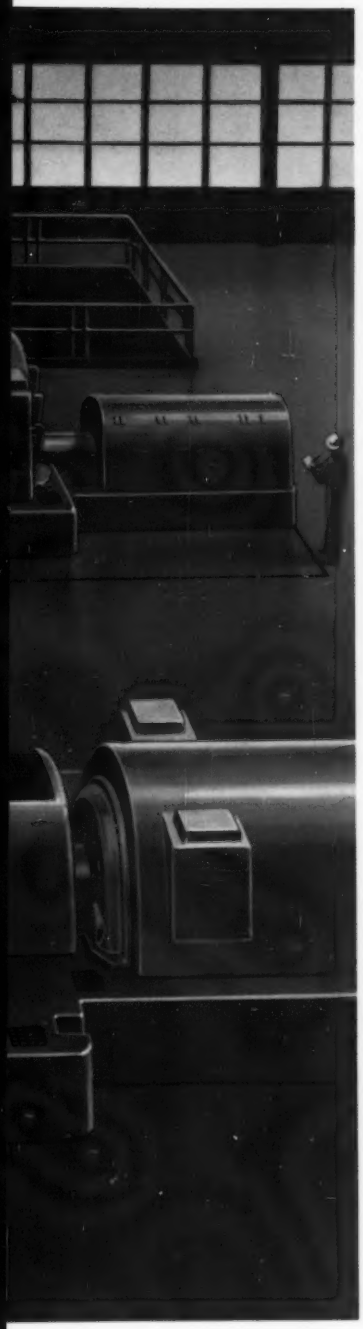
Now G-E design of cross-compound



LOW-PRESSURE SECTION (front) with 38-inch last-stage buckets carries 40% of unit's total load and operates at 1800 rpm. Low-pressure (about 80 psig) and low-temperature (560 F) steam enters opposite ends of section, flows towards center. Steam exhausts downward to condenser through a single condenser opening. Low speed allows use of large, efficient last-stage buckets and liberal exhaust hoods—two features vital to the efficient performance of higher-rated turbines operating at low-exhaust pressures.

HIGH-PRESSURE SECTION (rear) of opposed-flow design carries 60% of unit's total load and operates at 3600 rpm. Steam enters in the center, flows to the left (or front), exhausts downward. Reheated in the boiler, it re-enters turbine adjacent to initial steam entry, flows to the right, exhausts to crossover pipes leading to low-pressure turbine. This design permits admission of both initial and reheat steam near the center of the high-pressure casing, thus concentrating high temperatures in a small area.

units brings new high in efficiency



Longer last-stage buckets in low-pressure section give maximum efficiency

The 1800 rpm speed of the low-pressure section permits the use of longer last-stage buckets which provide greater efficiency at low exhaust pressures. On a 250,000 kilowatt cross compound unit, for example, this can mean a saving of as much as 50 million pounds of coal per year.

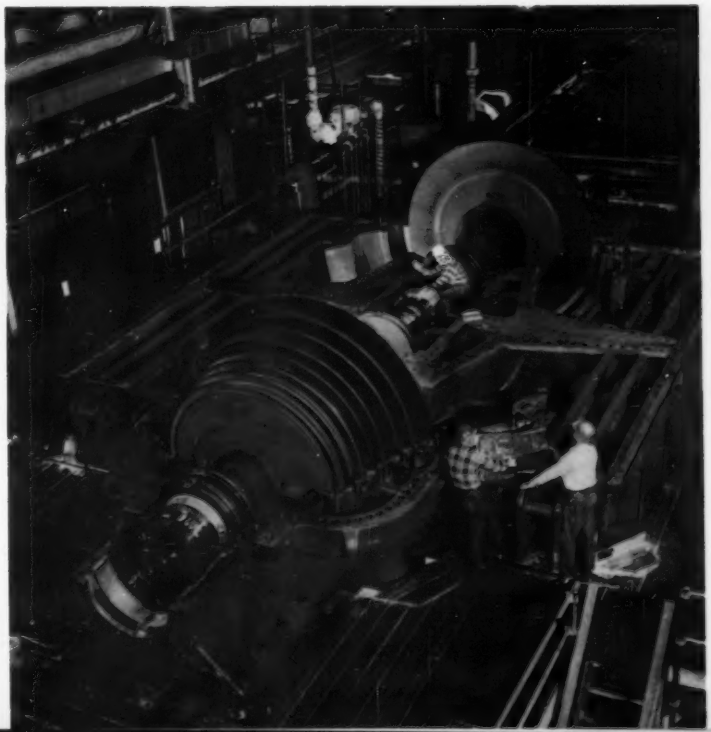
In the 3600 rpm high-pressure section, General Electric's opposed-flow design avoids severe temperature gradients with resulting thermal distortion by concentrating all high-steam temperatures in one small area of the casing. This design and the use of special high-pressure, high-temperature parts has resulted in outstanding efficiency.

Because there are two sections, each is comparatively short—a feature helpful in making more compact station arrangements. In fact, some designs of cross-compound units can easily be fitted into extensions of existing stations which cannot accommodate other designs of equal rating.

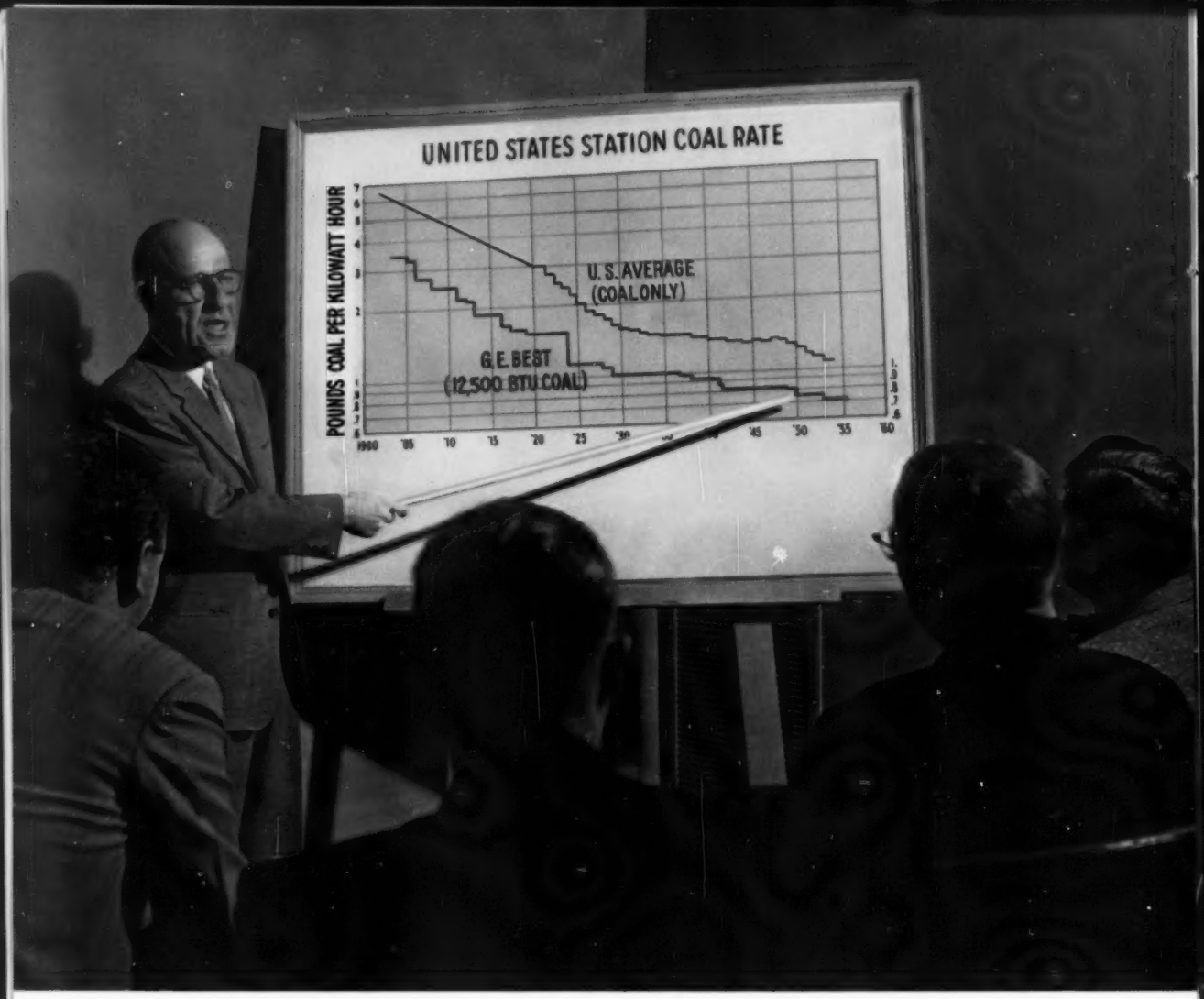
These are but a few of the ways in which General Electric's cross-compound design and arrangement have already achieved new highs in operating economy for turbine-generators. Read what C. W. Elston has to say about future turbine fuel economy on the next page.

Leader in Turbine-Generator Progress

GENERAL ELECTRIC



LOW-PRESSURE SECTION being assembled for careful factory inspection. This unit is one of the many large cross-compound turbines now being shipped to progressive electric utilities.



Can Turbine Fuel Economy Be Improved?

A statement by C. W. Elston, Manager—Turbine Engineering

The past twenty years have seen a phenomenal rise in the efficiency of steam turbine-generators. The best General Electric unit today requires 29 percent less fuel per kilowatt hour generated than the most efficient unit of twenty years ago. Can this improvement record be continued over the years to come?

It seems safe to answer that question in the affirmative. While future gains may not be quite so spectacular, there is considerable room for further improvement. The future increase in steam turbine-generator efficiency will come in part from the use of higher steam pressures and temperatures, and in part as a result of further development in the art of designing turbines.

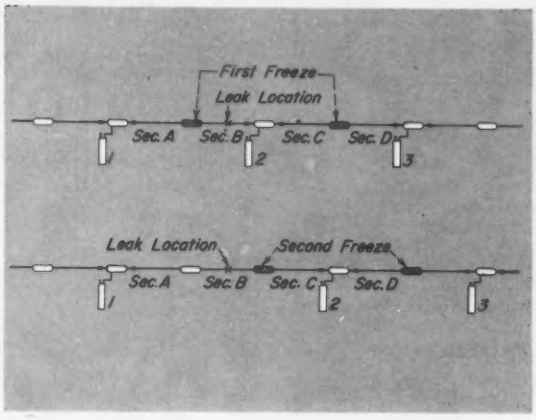
The opportunity for continuing improvement in turbine efficiency presents a challenge that is being met by the ingenuity and creativity of many G-E people in research, engineering, and manufacturing. Large Steam Turbine-Generator Department, General Electric Company, Schenectady 5, New York.

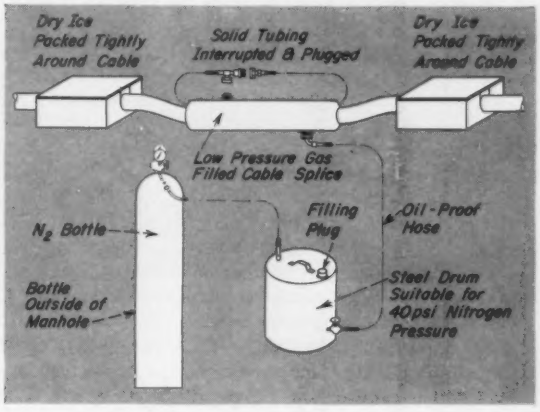
254-21

Progress Is Our Most Important Product

GENERAL ELECTRIC

DISTRIBUTION—Maintenance




Dry Ice Packed Tightly Around Cable
Solid Tubing Interrupted & Plugged
Dry Ice Packed Tightly Around Cable
Low Pressure Gas Filled Cable Splice
N_2 Bottle
Filling Plug
Oil-Proof Hose
Bottle Outside of Manhole
Steel Drum Suitable for 40psi Nitrogen Pressure

Freezing Helps Locate Gas-Filled Cable Leaks

JOHN GILL and WALTER H. LOHMANN, Assistant Engineers, Public Service Electric & Gas Co, Newark, N. J.

Isolating sections of a cable circuit by freezing facilitates location of leaks in low-pressure gas-filled cable on the system of Public Service Electric & Gas Co. An effective means of locating gas leaks becomes imperative with the increasing installations of low-pressure, gas-filled cable.

The freezing begins when the leak has been located to within two to five cable sections by means of flow meters or any other practicable method. The freezing technique may be used as a practicable method. The freezing then transforms the cable joint into a stop joint. This is accomplished by admitting oil to a joint sleeve and chilling it as it enters the cable gas passages. By chilling a sufficient length of cable on both sides of the cable joint sleeve, a stop may be established that can withstand a pressure differential over line operating pressure of upwards to 10 psi .

Equipment Listed

The equipment is as follows

1. Oil reservoir tank (approximately 5-gal capacity suitable for 40-psi test pressure).

2. Freezing chambers, approximately 6 x 6 x 12 in. minimum.

3. Nitrogen bottle and regulator.

4. Oil proof hose, and necessary accessory fitting to block tubing.

5. Dry ice (approximately 50 lb for each freeze location).

6. Oil (approximately 3 gal).

In this procedure fireproofing, if present, is removed for a length sufficient to permit mounting the freezing chambers. The chambers are secured to the cable by suitable means on both sides of the joint sleeve and as close as practicable to the sleeve.

Finely chopped dry ice is then packed tightly in the freezing chambers to assure intimate contact with the lead sheath. The ice must be repacked at intervals during the freezing procedure to sustain this contact. Hoses are then connected from the nitrogen bottle to the oil reservoir and from the oil reservoir to the bottom of the joint sleeve.

At this point the procedure varies for the different types of sleeves and connections. Nevertheless it is essential in any variation to interrupt the cable solid-wall tube and also prevent the oil flow into this tube. The preferred step is to fill the sleeve with oil with the sleeve unvented. Gas entering a vented sleeve through the open spiral tubes has a tendency to blow oil away from the freezing point. Furthermore, when the sleeve is unvented, the system pressure drop is minimized.

Nitrogen pressure on the tank is then increased slowly to approximately 20 psi. This admission pressure may be varied to control the rate of oil admission into the joint. In winter, it may be desirable to quicken the flow into the joint by heating the oil. Oil temperature, however, should be held below 100F to minimize loss of oil past the freeze points.

Oil volume in the reservoir tank should be sufficient to fill the joint sleeve with additional oil to compensate for oil loss into the cable. Oil loss into the cable is normally negligable. A dry oil should be used that is compatible with the cable oil. Solid type cable oil is available from at least one manufacturer. The sleeve should be nearly filled so that oil penetrates into the chilled areas. Oil level in the sleeve should be checked by means of a "dip stick" or other means.

Freeze Point May Be Held

When sleeve pressure is tight and gas pressure in the oil tank at approximately 20 psi, the nitrogen regulator is backed off. When the "freeze" has taken effect, no drop in pressure is observed on the low-pressure gage of the regulator. This pressure should be checked at intervals during maintenance of the freeze. It may be necessary to build up this pressure if the oil passes the freeze point into the cable. Some small oil loss may occur.

Experience shows that a freeze point may be held without difficulty for 3 to 4 hr or longer. The oil is readily drained from the sleeve by use of the cable gas pressure.

(*More How To on page* 152)

Gage Cargoes by Displacement

C. K. THIGPEN, Coal Procurment Agent, and **G. T. EVERETT JR.**, Coal Preparation Engineer, Appalachian Electric Power Co, Charleston, W. Va.

Feasibility of ascertaining the weights of barge loads by gaging displacements has been investigated by comparing gaged against known weights of loads, and interviewing persons using the displacement method. The displacement method provides an additional check on conveyor scales and a temporary substitute for scales out of service.

Of all displacement measurements studied, the first method explained hereafter is believed to be the most practical and accurate. The second is more complicated and less accurate as many variables, such as the weight of all water and sand under the false bottom, must be considered.

Method I—When a barge is available for both empty and loaded measurements, the following values should be recorded on a form similar to that shown below on this page:

A. Loaded freeboard (from top of gunnels to water line) at the six points in the sketch.

B. Empty freeboard at the same six points. Barge should not be pumped before these measurements.

C. Average freeboard (loaded and empty), calculated from measurements A and B respectively.

D. Tonnages (loaded and empty) based on value C and the freeboard chart for barges involved. Such charts, computed for each make and series of barge, can be computed from the draft charts furnished by the barge manufacturer for the series.

E. Net tonnage—The difference between loaded and empty values D.

Method II—When only the loaded freeboard measurements are available, the following should be recorded.

A. Loaded freeboard at six points in the sketch.

B. Average freeboard, calculated from measurements A.

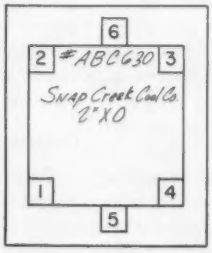
Freeboard	Tonnage	Tons Change Per Inch
1′	1160.00	11.49
1″	1148.51	11.49
2	1137.02	11.49
3	1125.53	11.49
4	1114.05	11.48
5	1102.66	11.39
6	1091.27	11.39
7	1079.88	11.39
8	1068.50	11.38
9	1057.11	11.39
10	1045.72	11.39
11	1034.33	11.39
2′	1022.95	11.38
1″	1011.56	11.39
2	1000.17	11.39
3	988.78	11.39
4	977.40	11.38
5	966.01	11.39
6	954.62	11.39
9′	85.65	——
1″	74.95	——
2	64.25	——
3	53.55	——
4	42.85	——
5	32.15	——
6	21.45	——
7 Water	10.75	10.70
7½ Line	0.00	10.75
8	10.75	——
9	21.50	——
10	32.25	——
11	43.00	——
10′	53.75	10.75

PORTIONS of freeboard chart such as applies to Amherst barges 630 to 641

Plant: TANNERS Creek

Date March 25, 1955

Loaded	Empty		Empty	Loaded
2'4"	9'3"		9'2"	2'4"
2'4½"	9'2"		9'3"	2'4½"
2'3½"	9'3"		9'3"	2'3½"



Average Empty Free board 9'2 3/3"

Average Loaded Freeboard 2'4"

Water Readings: 1– 2– 3– 4– 5– 6–

Chart Reading Loaded 977.40

Chart Reading Empty 57.12

Deductions for water, etc. —

Net Tonnage 920.28

REMARKS—(Amount left in barge, condition of barge, etc.)

Estimate 1½ tons left in Barge

GAUGED BY CTE COMPUTED BY JEF

FORM is used for recording barge displacement data. In obtaining data, freeboards are measured adjacent to hatches 1 to 4 and also amidship on each side

C. Total tonnage based on value B and freeboard chart for these barges.

D. Depth of water in hatches 1, 2, 3, and 4 in sketch.

E. Averages of values D.

F. Depth of water in hatches 5 and 6.

G. Maximum width of water in hatches 5 and 6.

H. Deductions from water, etc., in bulkhead and cargo tanks calculated as shown below.

I. Net tonnage equals value C less H.

Weight of water in bulkhead and cargo tanks is calculated from values E, F, and G, the barge-bottom length (L) and width (W), all in feet.

Weight of water in cargo tank = $3\ \mathrm{LxWxEx}\ \frac{62.5}{2{,}000}$ tons

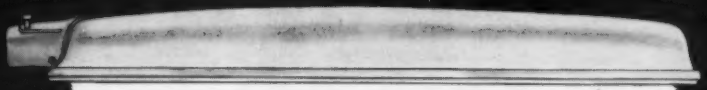
Weight of water in each bulkhead tank = $\frac{1}{2}\mathrm{FxGxWx}\ \frac{62.5}{2{,}000}$ tons

When barge bottom contains sand, the multiplying factor is $\frac{126}{2{,}000}$ instead of $\frac{62.5}{2{,}000}$.

(*More How To on page* 157)

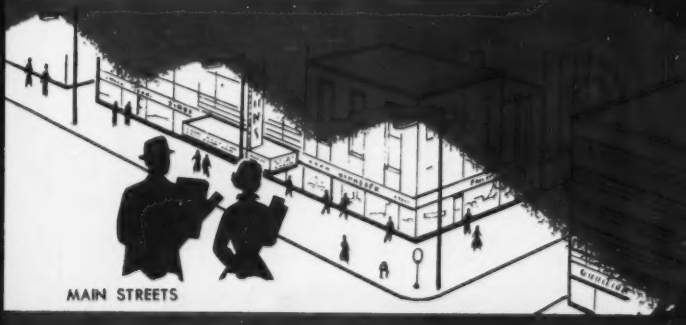
NOW . . . FLUORESCENT STREET LIGHTING FOR THE WHOLE COMMUNITY

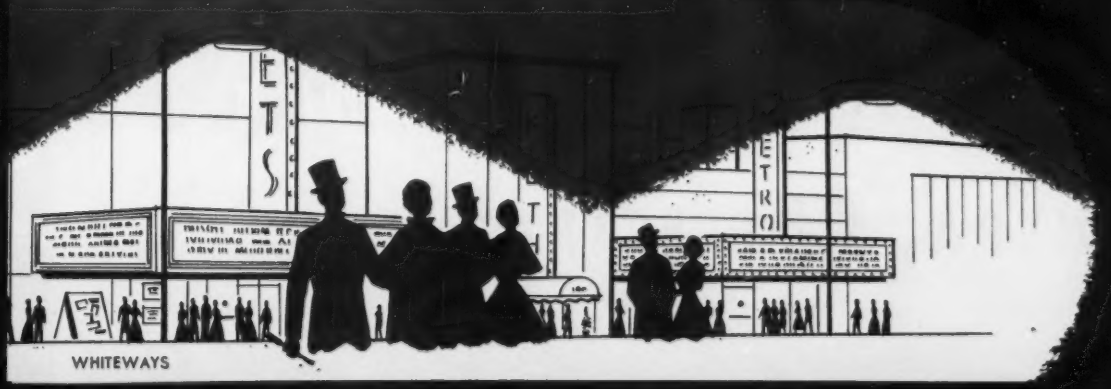
Introducing . . .



FLUORESCENT'S
FIRST FAMILY

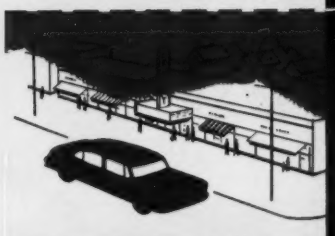
GENERAL ELECTRIC

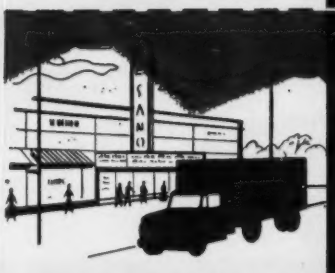


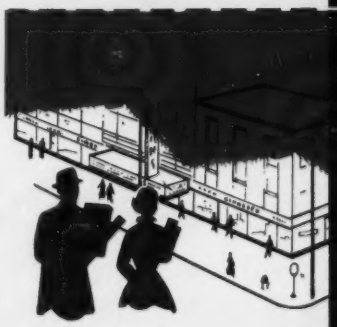


Five new G-E Fluorescent Luminaires

...each designed for a different area







Six years ago General Electric introduced the first fluorescent luminaires in this country and started an ever-increasing trend toward this type of street lighting.

Now General Electric introduces another first—Fluorescent's First Family, in sizes from 2,700 lumens to 64,000 lumens.

Up to the present, whiteways and main streets have accounted for most fluorescent use—because luminaires were only designed in one size. Now General Electric presents a complete new line of these luminaires in 5 different sizes. Now it is possible to work out a complete and efficient relighting program to fill **all** the street lighting needs of an entire community. This program was made possible by the co-ordinated engineering development of new luminaires, ballasts and lamps for outdoor lighting, thus assuring reliable and consistent operation in all kinds of weather. Consequently, in addition to whiteways and main streets, all these many advantages of fluorescent luminaires can now be brought to residential areas and traffic arteries, too.

BETTER VISIBILITY—it is generally conceded that you see better on a fluorescent-lighted street than on one illuminated to the same level by mercury or filament luminaires. This means greater safety, fewer accidents.

MORE COMFORTABLE SEEING—The soft diffused light of fluorescents provides more comfortable seeing because:

(1) **Lower luminaire brightness means less glare and interference with visibility.**

(2) **Broader areas of pavement brightness provide better "seeability."**

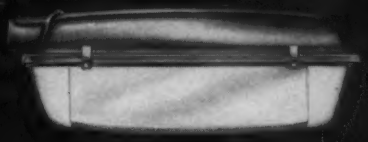
(3) **The "cool-white" light of fluorescents does not distort color.**

MODERN APPEARANCE—Distinctive lines, up-to-date design, plus the functional beauty of these new luminaires make them an asset to any street's appearance, and increase civic pride in the community.

LOWER MAINTENANCE—Operating experience indicates that the average effective life of fluorescent lamps in street lighting service is more than two years. In addition, neither the shatterproof, plastic globe nor the light output is unduly affected by extreme weather.

ECONOMICAL—Fluorescent's lower maintenance, easier installation, weatherproof engineering all add up to economy plus practicality . . . more value per dollar invested.

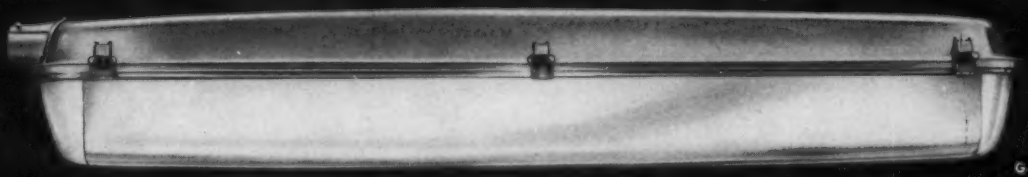
GENERAL ELECTRIC



G-E Form 202S
(Two two-foot lamps)
2700 lumens for
Residential Areas

FLUORESCENT'S FIRST FAMILY

G-E Form 204S
(Two four-foot lamps)
6600 lumens for
Secondary Traffic Areas

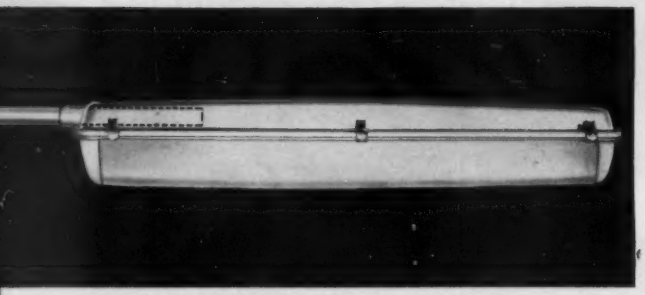


G-E Form 206S
(Two six-foot lamps)
10,600 lumens for
Primary Traffic Areas

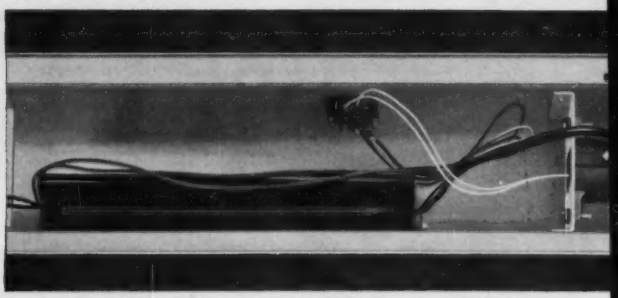
G-E Form 406S
(Four six-foot lamps)
21,200 lumens for
Main Streets

G-E Form 1206S
(Twelve six-foot lamps)
64,000 lumens for
Whiteways

Only Fluorescent's First Family has all these features to simplify installation, lower maintenance, give maximum performance



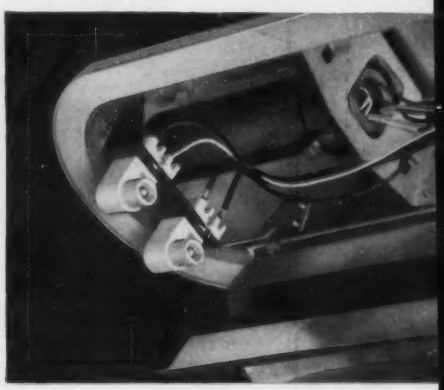
SLIPFITTER MOUNTING . . . pipe bracket slides easily into luminaire, giving perfect support and eliminating the heavy, cumbersome clamp brackets which concentrated all stresses on the house-side end of the luminaire. A simple, self-contained, two-bolt leveling adjustment permits fast, easy leveling. The slipfitter design also gives wide latitude in mounting placement.



PRE-WIRED TERMINAL BOARD, INTEGRAL BALLASTS . . . located right near the slipfitter entrance, the terminal board makes wiring quick and simple. Since all secondary leads are already in place, only two primary leads have to be connected. In addition, ballasts are mounted inside the luminaires and come pre-wired to the terminal board and the lamp sockets.

WEATHERPROOF ENGINEERING . . . a new resilient gasketing material is used between the hood and the globe, assuring a uniform, positive seal against all elements all the way around. The one-piece plastic globe retains its clear appearance in all weather, be it fair or foul.

ONE-PIECE, SIDE-HINGED GLOBE AND HINGED REFLECTOR . . . plastic and light, this globe opens on hinges from either side of luminaire for safe, easy maintenance. No more worrisome, multi-piece, fabricated construction! Aluminum reflector is for easy access to terminal board, ballast and leveling adjustment.



SPRING-LOADED SOCKETS—NEW BASES . . . new type spring-loaded sockets provide a simple and secure means of installing the new, recessed, double-contact-base lamps. No more jiggling is necessary to line up lamp pins with socket—lamps can be installed or removed with one hand. Here's relamping at its easiest and safest!

Seeing is believing

There is probably Fluorescent street lighting near you—your local G-E representative should be able to tell you where. Go see for yourself how vastly superior this type of street lighting is to all other forms of illumination. Complete information on "Fluorescent's First Family" is available at your nearest G-E Apparatus Sales Office. Or write Section 452–166, General Electric Company, Schenectady 5, New York.

"Out of Darkness," a dramatic 16-mm sound film on how one community met and solved its street lighting problems, is available from your nearest General Electric Apparatus Sales Office.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Tester Checks Fluorescent Street Lamps

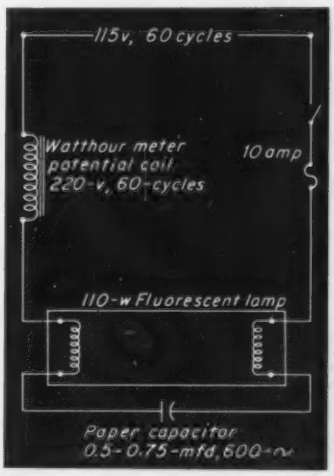
Detects lamps which despite good filaments fail to ignite and aids California-Pacific in spotting failure that may prevent all lights from lighting

W. G. SANDERS, Division Engineer, California-Pacific Utilities Co, Susanville, Calif.

Simple, portable tester for checking 100-w fluorescent street lamps is proving of value to California Pacific Utilities Co.

This handy device is particularly useful in detecting lamps which have good filaments but fail to ignite in service. It may be used also to check mercury vapor street lamps.

In multiple-unit fluorescent luminaires used by California-Pacific, the failure of one lamp to start may prevent all lamps from lighting. Before the tester was developed, the procedure for checking lamps in luminaires mounted 30 ft above a busy street was tedious at best. Each lamp was replaced with a new one until the faulty unit was found. Two faulty lamps in a luminaire complicated the problem. With the tester, the faulty lamp may be found quickly.



It uses an inductance consisting of a potential core and coil from a 200-v watthour meter and a 0.75-mfd, 600-v paper capacitor. With most potential coils, a capacitor of from 0.5 to 0.75 mfd is required for proper ignition of good lamps. Completing the tester are sockets for the lamp, a 10-amp fuse, a switch, and a plug for the 115-v, 60-cps supply. All equipment is mounted on a 5-in. x 6½-ft board. Total weight is 7¼ lb.

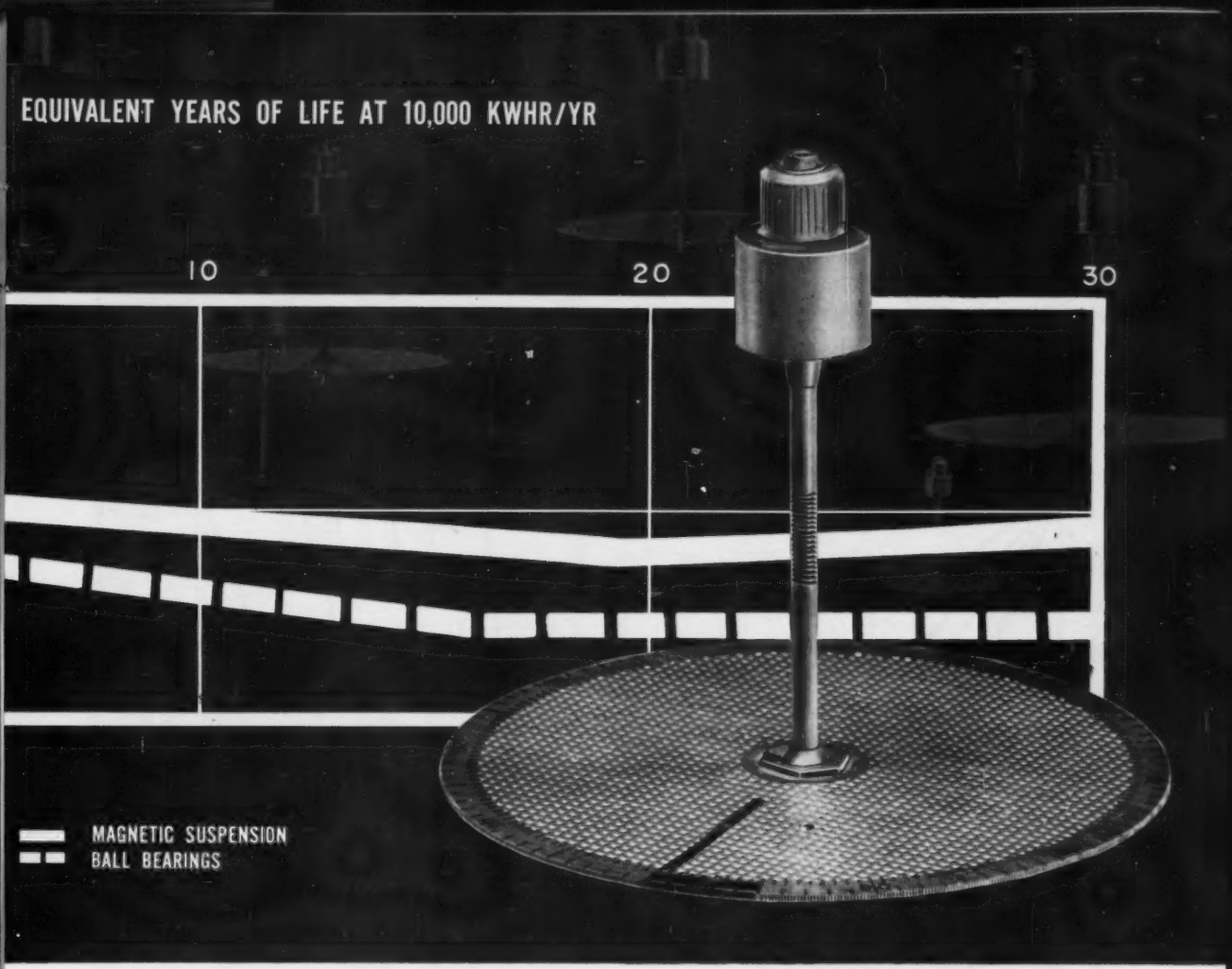
The tester is carried in a ladder truck so that each lamp may be checked at the pole. A portable generator in the truck supplies power for field testing. The tester is used to check replacement lamps in the shop before they are taken into the field.

(*More How To on page* 164)

Life tests prove . . .

GREATER SUSTAINED ACCURACY

ALL THE COST-SAVING features of General Electric's I-50 meter family have been proven by the more than 6,000,000 I-50's in service today.



G-E MAGNETIC SUSPENSION ASSURES ACCURATE MEASUREMENT OF TOMORROW'S LOADS

New test data on meter performance, compiled in G-E research laboratories, prove that General Electric's revolutionary "floating disc" will accurately measure tomorrow's greater loads. During these accerated life tests, identical loads were applied to G-E meters with magnetic suspension and to meters using other types of bearing systems to support the moving element.

The test results, based upon a total load of 300,000 kwhr (the equivalent of 30 years' operation at 10,000 kwhr), proved that only General Electric meters with magnetic suspension offer you these important benefits:

Greater sustained accuracy (see chart above)

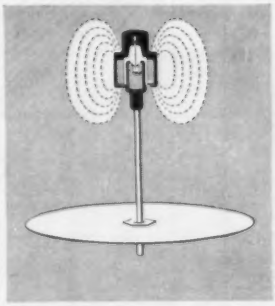
No bearing wear

Greater return on your meter investment

In addition to magnetic suspension, G-E meters provide you many other money-saving features. For example: all meters of the G-E I-50 family offer you a unique one-piece retarding system which assures stability and long life . . . rigid unit construction for maximum strength . . . corrosion-resistant and easier-to-read pointer and cyclometer registers.

For the meter you can install now and depend on for many extra years of accurate service, specify the meter designed for the greater demands of tomorrow's electrical living. Choose meters of the General Electric I-50 meter family.

For more information contact your nearby General Electric Apparatus Sales Office, or write General Electric Company, Section 621-5, Schenectady 5, N. Y.



MAGNETIC SUSPENSION of rotor eliminates conventional bearings, greatly reduces maintenance and replacement costs.

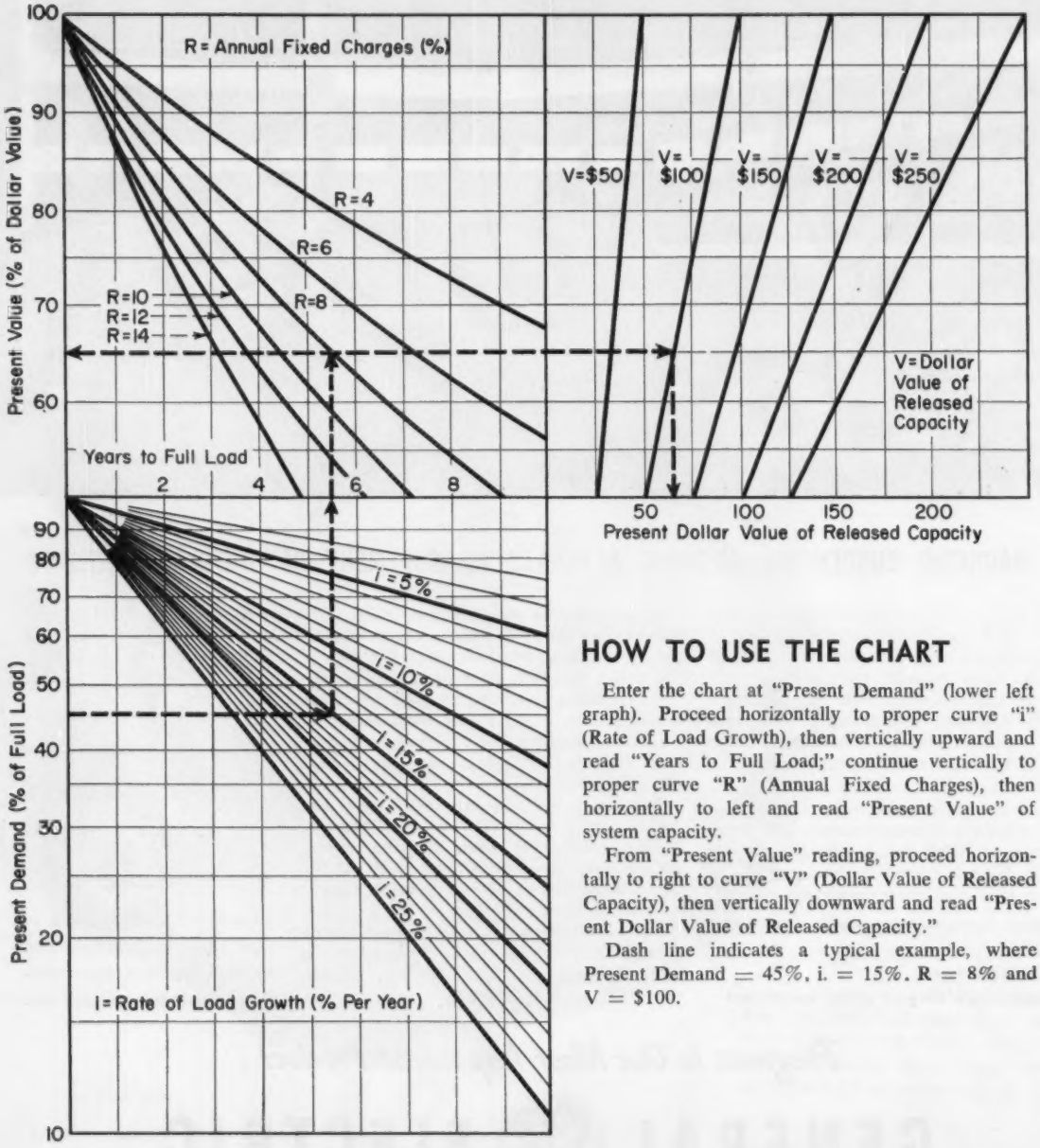
Progress Is Our Most Important Product

GENERAL ELECTRIC

Chart Gives Dollar Value of Released Kva

Present dollar value of kva capacity released by capacitors may be determined readily by the graphs, when the following are known: (1) the present load on the system (or feeder, station, etc.), (2) the rate of load growth, (3) the fixed charge rate, and (4) the book value of system capacity.

E. J. POLASEK, Consulting Electrical Engineer, Eau Claire, Wis.



HOW TO USE THE CHART

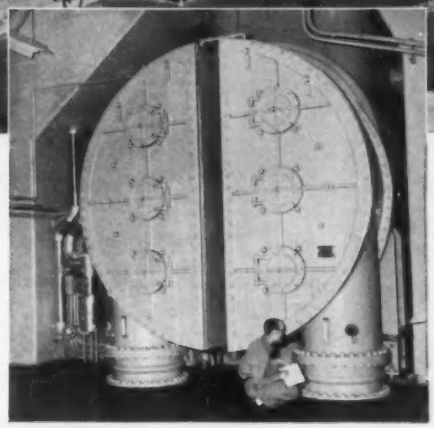
Enter the chart at "Present Demand" (lower left graph). Proceed horizontally to proper curve "i" (Rate of Load Growth), then vertically upward and read "Years to Full Load;" continue vertically to proper curve "R" (Annual Fixed Charges), then horizontally to left and read "Present Value" of system capacity.

From "Present Value" reading, proceed horizontally to right to curve "V" (Dollar Value of Released Capacity), then vertically downward and read "Present Dollar Value of Released Capacity."

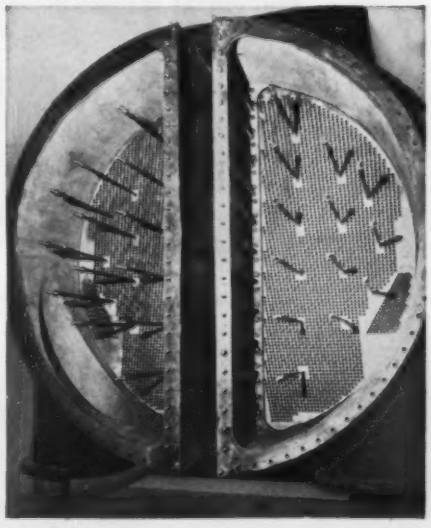
Dash line indicates a typical example, where Present Demand = 45%, i. = 15%. R = 8% and V = $100.

REVERE 10% CUPRO-NICKEL SOLVES CORROSION PROBLEM FOR FLORIDA POWER CORPORATION

About six years ago the Florida Power Corporation was experiencing condenser tube failure at its Bayboro plant in St. Petersburg. Revere's Technical Advisory Service was called in, and recommended replacing the failed tubes with 10% Cupro-Nickel, which has a marked resistance to corrosion from brackish water. This recommendation proved successful. As a result, when Florida Power planned to add a new 135,000 KW plant, named after A. W. Higgins, Revere 10% Cupro-Nickel tubes were specified. All three units in the new plant are thus tubed. The tubes are 7/8" OD x 18 BWG, 24' 7" long. A few spares are kept on hand for possible replacement, but with regular cleaning to remove debris (small bits of shell, etc.), the tube life has been exceptional, thus adding to economy of operation and increased service to a fast-growing area. . . . If you have questions regarding condenser tube selection and service, get in touch with the nearest Revere Sales Office. Remember to specify Revere.



Exterior view of one of the condensers in the Higgins plant, and below, one of the three condensers ready for tubing. Condensers made by C. H. Wheeler Mfg. Co., Philadelphia, Pa.



REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

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TO FIT YOUR NEEDS...

Whether you control capacitor switching as a function of Time, Amperes, Volts, Watts or Vars—Sangamo can furnish economical and reliable control equipment.

Sangamo Time Switches are synchronously operated and may be equipped with automatic carryover to keep them "on time" during current interruptions.

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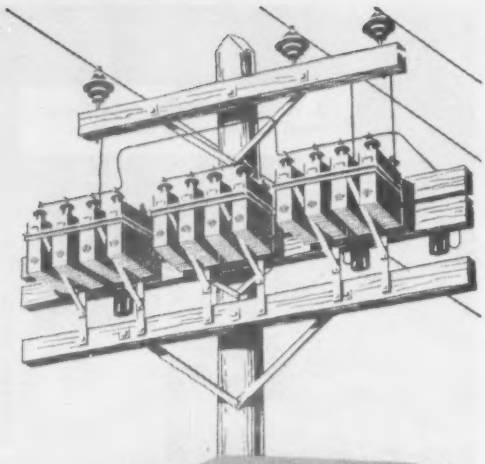
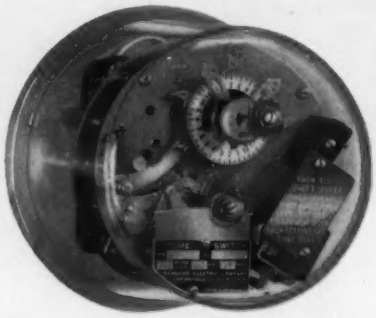
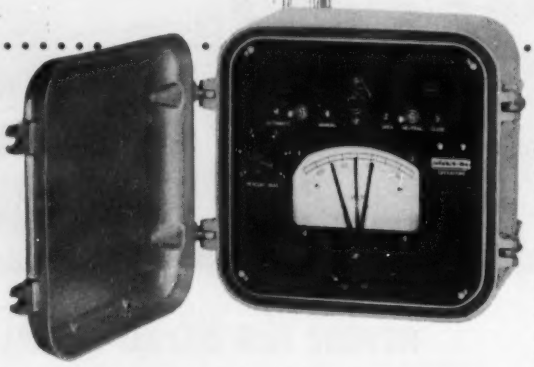
Ask your Sangamo Representative, or write us today.

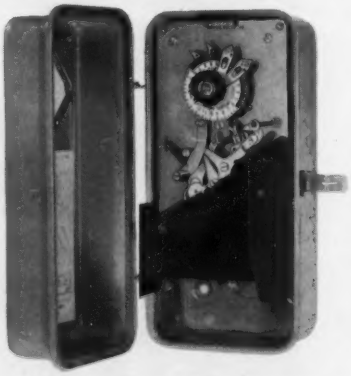




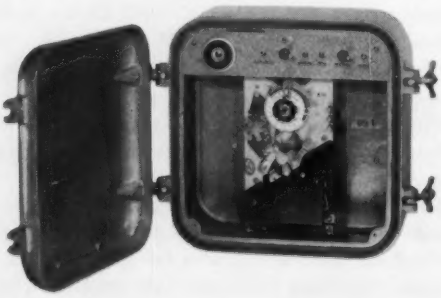
Type WS Synchronous-Carryover Time Switch for socket mounting.



Type VS Socket-connected Lincolntrols switch capacitors as a function of voltage. Type AS is sensitive to amperes, Type RS responds to kilovars. Bottom connected, as well as other mountings, are also available.



Type L Synchronous Time Switch in gasket-sealed case.



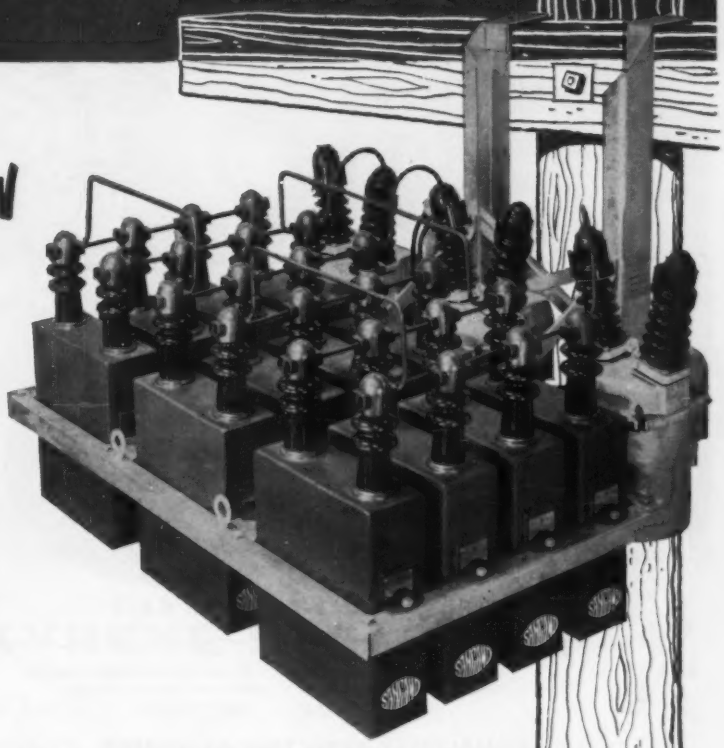
Type AW Synchronous-Carryover Time Switch for socket mounting, includes fuse and switches for manual and automatic operation.

SANGAMO ELECTRIC CO.

for quick, economical distribution circuit installations

choose

Sangamo's New Auto-Var Pole-Type Capacitor Equipment



Now Sangamo's Diaclor Power Capacitors are available in factory-assembled and wired Auto Var equipment for pole-type installation. They are designed for easy installation, structural soundness, and excellent electrical performance in the improvement of power factor.

They offer all these features:

- Sangamo 25 Kvar Diaclor Power Capacitors.
- Hot dip galvanized steel rock for cross-arm mounting.
- Available with or without electrically-operated oil switches.
- Weatherproof junction box with terminal block for control wiring.
- Insulating caps on all capacitor and oil switch terminals.
- Clamp-type ground stud that accommodates #8 to #2/0 wire.
- Neoprene jacketed, #6 solid conductor connections between units.

Write for full information.

SANGAMO

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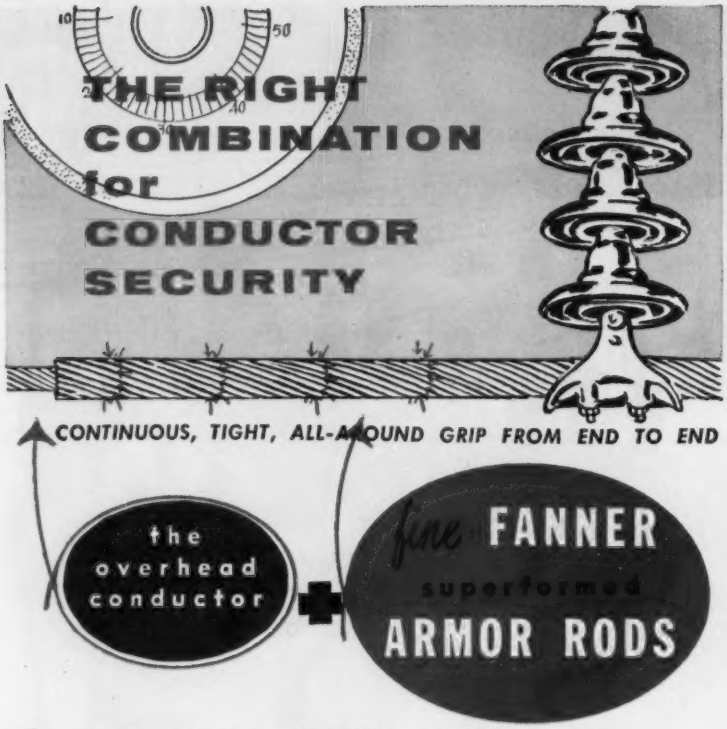
SPRINGFIELD, ILLINOIS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CONTINUOUS, TIGHT, ALL-AROUND GRIP FROM END TO END
the overhead conductor
fine FANNER superformed ARMOR RODS
UNIFORM FULL-LENGTH GRIP
Fanner Superformed armor rods contact conductor permanently and tightly at every point — not just at clamps.
COMPLETELY EFFECTIVE ARMORING
Exclusive, precision formed construction provides rugged, lasting protection for conductor.
DEPENDABLE PERFORMANCE
Every installation fits perfectly into place. Fanner precision design eliminates special skill on part of linemen.
RE-USABILITY
When reconductoring or line relocation demands it, Fanner Superformed Rods may be reapplied without rod waste or loss of armoring.
LOW INSTALLED COST
Fine Fanner Superformed Rods provide both initial and long term economy through low cost, easy application and multiple capabilities.
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Planned Oil Maintenance Gives Savings

PAUL E. HILLIARD, Division Substation Supt, Appalachian Electric Power Co, Bluefield, W. Va.

A program for maintaining insulating oils has proved practicable and economical for Appalachian Electric Power Co. It consists of testing, reconditioning, and reclaiming oil in expensive equipment where its deterioration is caused principally by oxidation and moisture.

The test schedule is adjusted to the operating conditions of equipment and to the age of the oil therein. Usually oil is examined annually. But oil inspections are more often when incidental to the inspection of frequent-duty breakers. The interval between tests on oil in inert-gas-type transformers may be longer than a year.

In the field four tests determine the serviceability of insulating oil, or whether the oil requires being sent to the laboratory for further analysis. The field tests are for dielectric strength, color and appearance, neutralization value, and power factor.

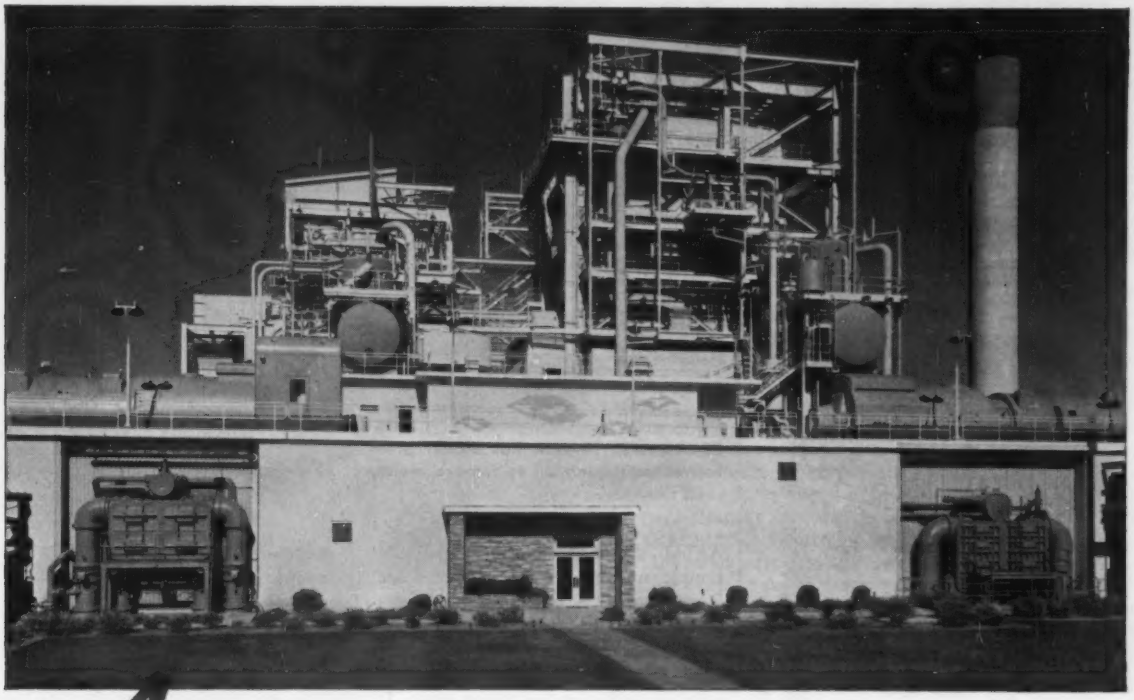
Must Withstand 25 Kv

The most common test in the field is for dielectric strength. It detects moisture in the oil, but is less effective in showing the presence of other contaminants. It is made by applying 15 to 30 kv, in steps of 2.5 kv, to a $\frac{1}{10}$-in. spark gap in a cup containing an oil sample. The gap is between two parallel, polished brass discs, 1-in. in dia and with square edges. Usually several samples are tested and the results averaged. Oil which does not withstand 25 kv is slated for reconditioning.

When a sample is really representative, color is an important clue to oil condition. Excessively dark color indicates oxidation, overheating, or soluble contaminants. For accuracy, a sample should be compared with

Adapted from a paper presented at the Southeastern Electric Exchange Engineering & Operation Section meeting in New Orleans, La.

(*Continued on page* 166)



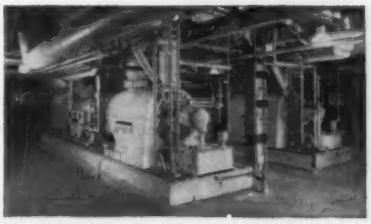
Again KYRENE STEAM PLANT

saves under-turbine space with I-R rectangular condensers

When Unit No. 1 of Salt River Power District's Kyrene Steam Plant went on line in June 1952, its 30/33,000 kw turbine-generator was served by a space-saving 27,500 sq. ft. I-R rectangular condenser, with I-R circulating and condensate pumps.

Now the same economy of under-turbine space has been extended to the newly completed Unit No. 2. Here, at right in photo above, the 60/66,000 kw turbine-generator is served by a 47,500 sq. ft. I-R rectangular condenser—again with I-R circulating and condensate pumps.

Designed and built by the Bechtel Corporation, the Kyrene plant located near Phoenix, Arizona represents the last word in modern, outdoor-type design. To assure maximum continuity of service, all major equipment was selected on the basis of long-range *dependability* in continuous, heavy-duty service. That's one of the vital but unseen features that's built into every item of Ingersoll-Rand steam plant equipment. Ask your I-R representative for complete details on the equipment best suited to your needs.



I-R BOILER-FEED PUMPS serve new generating unit, too

The 642,000 lb. per hr., 1500 psi steam generator for Unit No. 2 is served by the two Ingersoll-Rand high pressure, double-case boiler-feed pumps shown above—each rated 1,560 gpm, 4100 ft. head. Pump speed is flexibly controlled by an automatic fluid drive coupling.

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PUMPS • CONDENSERS • TURBO-BLOWERS • COMPRESSORS • AIR & ELECTRIC TOOLS • ROCK DRILLS

Recommended
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METER TESTING ACCESSORIES
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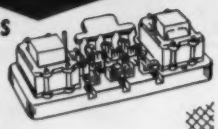
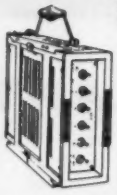


ACCURATELY MEASURES REACTIVE POWER: when properly connected to a watthour meter will provide for that meter the proper potentials lagging 90° in phase from the normal circuit potentials, together with a switching arrangement whereby the meter connected thereto can be checked as a straight watthour meter.

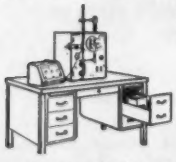


TYPE TRF RESISTANCE LOAD

The addition of a current operating fan on this item is to aid the natural draft condition and make possible a maximum capacity of 24 amperes load current at 240 volts in an aluminum case.

ROTARY TAP SWITCH

ALL INCLUSIVE FEATURES: high current capacity, non-arcing, high voltage capacity, inductive load capacity, numerous circuit combinations, special high current connections, positive action, compact design, fully enclosed.

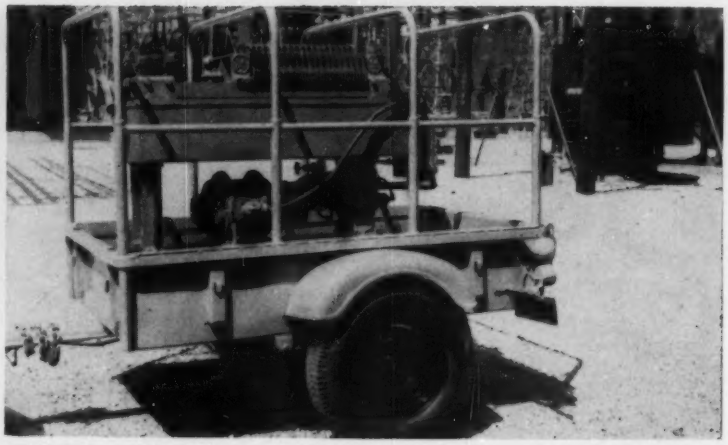


METER TEST BOARD

So many requests have been received to provide a packaged, up-to-date, compact meter test board unit, we are presenting this equipment which has many features for efficient operation.

Write for Complete Information

EASTERN SPECIALTY CO.
PHILADELPHIA 40, PA.



FOUR-WHEEL TRAILER has blotter press, paper drying oven, and 250-gal tank for reconditioning oil to remove moisture. This trailer handles easily in transit

ASTM standard colors. When the sample matches color number 5 or more, the oil is scheduled for reclamation.

The neutralization value, an expression of acid content, indicates whether oxidation has taken place. It is the milligrams of potassium hydroxide required to neutralize the acid in 1 gram of oil. Oil having a neut number 0.5 mg or greater is reclaimed.

Fullers Earth Used

Power factor tests made with a Doble test set show up both moisture and conducting and semi-conducting oil-soluble contaminates. Oil having a power factor of 1.75% or greater is reclaimed.

Oil that passes the four tests is suitable for service. Other oils can be made suitable by reconditioning or reclaiming. When oil cannot be reclaimed satisfactorily, a sample is sent to the AG&E General Laboratory for further analysis and the laboratory's recommendation.

Most reconditioning to remove moisture is done with a blotter press and paper drying oven mounted on a two or four-wheel trailer containing a 250-gal tank and other essential items. The trailer is used because it handles easily in transit. Some reconditioning is done with centrifuges permanently installed at larger, old stations.

At new large stations a three-compartment storage tank is installed. This holds sufficient oil for the largest piece of equipment. Non-corrosive pipe is provided in racks for connecting between tanks, equipment, and the filtering trailer.

Reclamation of deteriorated oil is done with the Fullers earth percolation method, after which an inhibitor is added. This method provides the best quality of reclaimed oil at the lowest cost.

The percolation filter is like a gigantic coffee dripolator. A steel tank 4 ft in dia and 12 to 16 ft high is set on a concrete foundation. Mounted inside the tank, 20 in. from the bottom, is a perforated steel plate. On it are laid a sheet of hardware cloth and then a layer of canvas. At the bottom of the tank is a catch basin and a float-controlled pump.

DBPC Inhibits Oil

In operation, the filter tank is charged from the top with a 6-ft bed (2,650 lb) of 60/90 mesh Fullers earth. Oil is pumped into the top of tank filters through the earth into the basin, from which it is removed intermittently. Rate of filtering is 100 to 120 gph.

First oil to pass through a fresh charge of Fullers earth has a neut number of zero and a color number of one. Filtering is stopped when the mixed batch from the run reaches a color number of 2.5 or a neut number of 0.1 mg. Usually the neut number determines the stopping point, and the power factor is 0.1% or better. In the filtering process 265 gal of oil are lost by absorption in the 2,650 lb of earth.

Life expectancy of reclaimed oil is less than half that of new oil, if not inhibited, because of progressive oxidation. However stability can be provided by the addition of DBPC.

(*More How To on page* 171)

Here Is a Tester, Testing the Tool, That Tests the Circuit, That Tests the Insulator

There's an old, well-worn definition of an Electronics specialist: "A man who can do as much with 15 tubes as an ordinary electrician can with a relay."

In a way, this is even more fabulous. We use 15 tubes plus an oscilloscope just to watch a relay work!

In our outdoor test yard is a long-time investigation of various insulator shapes exposed to natural conditions, including industrial contamination. All specimens are under continuous full potential. Each is connected to an instrument panel in the laboratory where its leakage behavior is carefully analyzed and recorded. Occasionally the surges come in fast and furious. We want to be sure our relay system doesn't lag behind, or doesn't foul-up the data. Therefore, every relay goes through a course of calisthenics before it is installed -- hence this apparatus that would bring joy to Rube Goldberg.

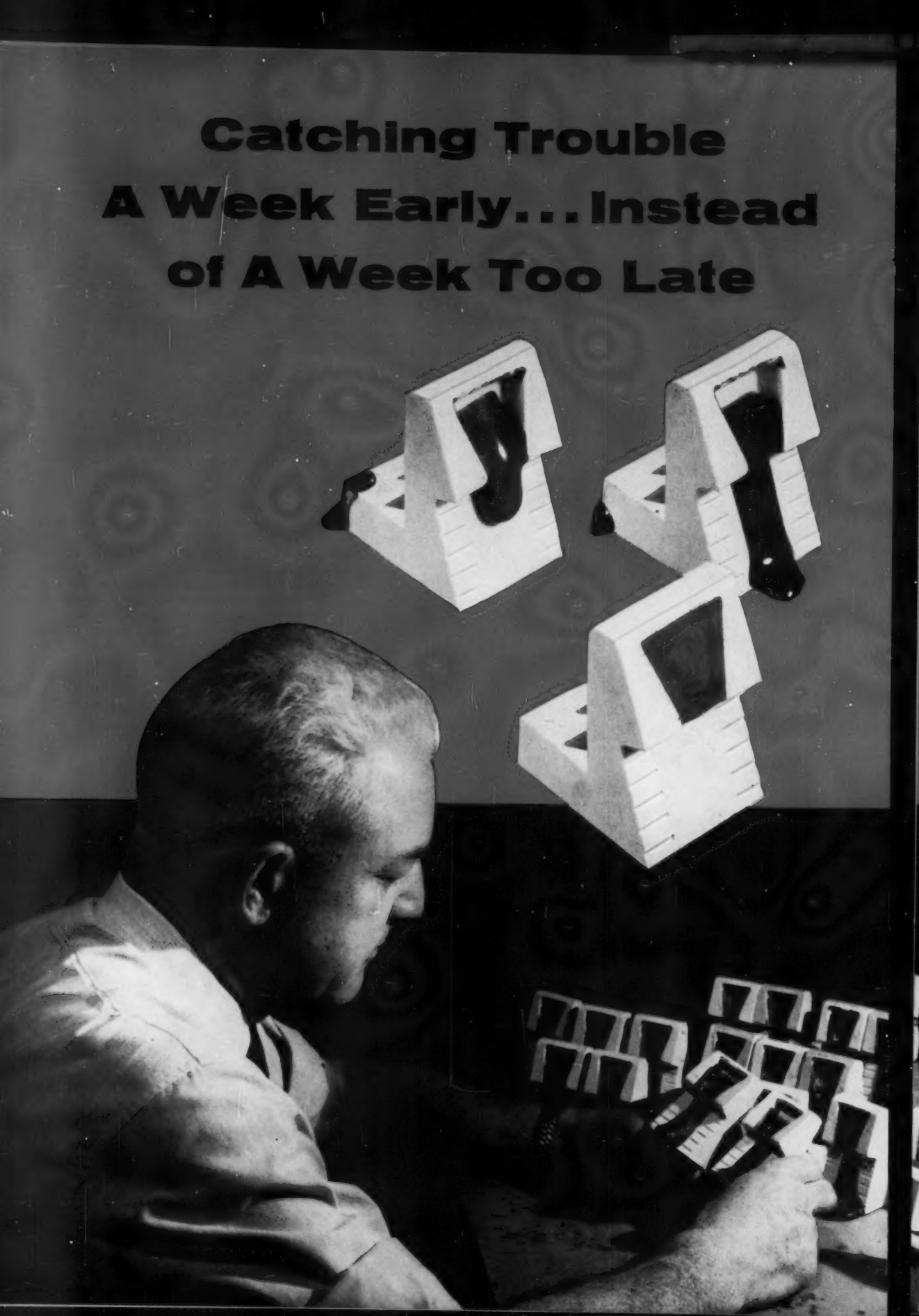
All the conditions that might develop on our exposure racks can be duplicated by a flip of a switch or a twist of a knob. Relays that graduate from this hard school are fit to go into service; aiding in the accumulation of a mass of information leading to a true evaluation of insulator shape related to natural exposure. How this investigation can pay-off in practical application is too obvious to belabor.

Sure, it's a home-made thing they call a "bread board" around the laboratory. But to those of us who lay big store by research, it is a means of calibrating the tools that must be right before valuable answers can be obtained. It's one of the little things that all roll-up into a very big thing we call Technical Competence.

* TC

* TECHNICAL COMPETENCE, the heart of every Ohio Brass insulator

Catching Trouble A Week Early... Instead of A Week Too Late



Glaze on insulators becomes "wet" in the heat of the kiln. It slowly runs, depending on the pitch of the surface. Uncontrolled, this can cause thin sections or build-up to excessive thickness in certain areas. It can upset the precision application of high strength glaze where a specific thickness of this material adds to the strength of the porcelain body. Glaze flow must be kept under close control.

But glaze is made of a complex mixture of minerals some of which are erratic products of Nature. It's not enough to devise a glaze compound -- it has to be checked, checked often, checked carefully.

Visual inspection of insulators out of the kiln is a common method of detecting glaze deficiencies by observing the surface. This is often a week or more, and thousands of insulators, after the trouble has developed.

At O-B, insulators *go into the kiln* with a glaze coating we know is good. We know because we have tested its composition for flow characteristics.

This is just one more detail of how Technical Competence is applied to the production of a consistent product, intended to do a consistently good job. It is one of a host of reasons why O-B insulators -- large or small, high or low voltage -- give you the longest life and greatest freedom from trouble your money can buy.

OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Lt'd., Niagara Falls, Ont.

Production and experimental glaze compositions are checked for flow characteristics in this practical, but precise, way. The glaze material is packed into an open-bottom chamber in a special refractory support. Time and temperature are under careful control throughout the firing process. Tendency for the glaze to flow is read on a set of scale divisions. Comparisons with each other, and with a standard, are thus made. Illustrations show the packed support before firing, the firing process, inspection of various specimens, and typical test results.

the heart of every Ohio Brass insulator

How We Keep Mistakes on a Small Scale

Many porcelain shapes are "dry turned." It's a process much easier to do wrong than right. The clay must be in proper chalk-hard condition. The tool must have a critical cutting shape, rake, angle, and clearance. The feed must be within close limits. The cut must be just so deep, no more, no less.

Ignore these many factors and you create microscopic fissures that lead to cracking in the heat of the kiln. Some cracks proceed to destruction of the piece. Others are less easy to detect. In short, "dry turning" is a precision operation if you want it to work.

There are two ways to refine this process. One is to live through an agonizing period of trial and error in the factory, spoil many pieces, disrupt production, and maybe or maybe not develop a really sound technique. Another way is to turn the job over to technical men with a deep understanding of clays and processes. Let them work out and specify a procedure correct in all its details.

Here, O-B has a unique advantage. In our Pilot Plant -- literally a small factory within a big one -- processes are perfected independent of, and ahead of commercial production. The Pilot Plant is expected to get into trouble. That's their business. And they lick that trouble on a small scale before it ever shows up in a commercial product.

Experimental production is somewhat of a luxury in the average manufacturing organization. But insulator manufacture isn't exactly "average," when failure of one in a million is frowned upon. Such high standards in our product are developed and protected by Technical Competence, the heart of every O-B insulator.

OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Lt'd., Niagara Falls, Ont.

4653-H

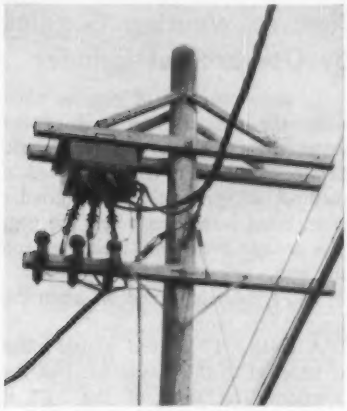
*TECHNICAL COMPETENCE the heart of every Ohio Brass insulator

Pole-Top Switches Improve Operations

R. F. LA FONTAINE, Regional Superintendent, Iowa Electric Light & Power Company, Cedar Rapids

To help solve the problem of paralleling substations with single-blade switches at tie points on feeders, the Iowa Electric Light & Power Co installs gang-operated, load-break, oil switches at these tie points. The switches are mounted at the pole top and controlled from the pole base. They are installed on new 3-phase, 2,400/4,160-v feeders and replace single-blade disconnect switches on older construction.

Past practice had been to place single-blade switches at the source and at strategic tie points on 4,160-v feeders between substations. Substations are served at either 13.8 or 34.5 kv.



Unless regulating voltages were adjusted closely, trouble is experienced due to substation breakers operating when paralleling stations with single-pole switches.

Furthermore considerable flashing occurs at the blades.

The oil switches have eliminated unintentional breaker operation and stopped the flashes when switches are operated. With the oil switches, restoration of service is speeded in an emergency since, with the operating handles at the base of the poles, linesmen are not required to operate them.

(*More How To on page* 172)

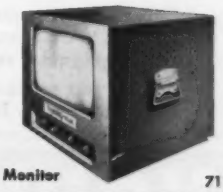
USE DIAMOND UtiliVue

INDUSTRIAL TELEVISION SYSTEM

Everyone can see those tall chimneys that carry off gases or fumes from your plant. Many of these people will judge unfairly . . . will blame you for everything from smog to tattle-tale grey wash . . . even though there is smoke for only a few minutes a day.

The "UtiliVue" (wired television) will bring a sharp picture of the stacks to the control panel or any other convenient point. The operator SEES the smoke exactly as do people on the outside and takes corrective action at once. Chimney smoke is only one of many things that the "UtiliVue" can watch to your profit and advantage . . . in fact, anything that is too remote, too hot, or too dangerous to observe directly. Get in touch with your Graybar Distributor or use the coupon below for informative booklet.

UtiliVue Camera



Monitor

7119

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Diamond Specialty Limited—Windsor, Ontario
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ELECTRONICS DEPT., P.O. BOX 56K
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YORK-HOOVER
TWO-MAN
LINE BODY

model 5000 WD is a sound investment for YOU...

because it will do your line work *at less cost—quicker* and *safer.*

With complete equipment it will dig the hole and set the pole, normally in a matter of minutes, all within full view and control of the truck operator, and—*the pole derrick is always ready for immediate use.*

Backed by 61 years' experience and embodying skillful engineering and honest workmanship, the model 5000 WD body with equipment represents a truly outstanding investment.

Before you purchase any line equipment, make sure you have thoroughly looked into this modern, up-to-the-minute unit by York-Hoover.

YORK-HOOVER
PUBLIC UTILITY BODIES

YORK-HOOVER CORPORATION
BODY DIVISION
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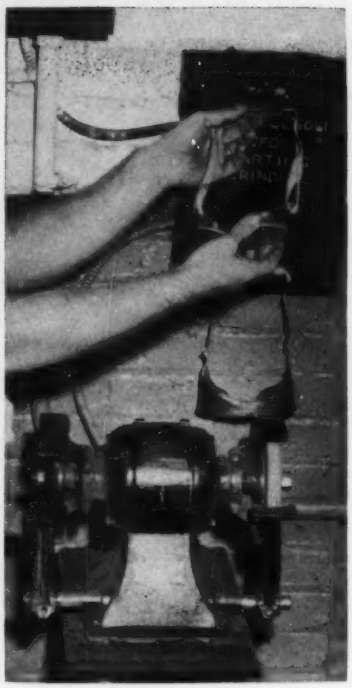
SAFETY



Assures Wearing Goggles By Operator of Grinder

To assure the use of goggles when using the grinder, personnel of the meter department of Texas Electric Service Co at Ft Worth devised a method of preventing the grinder from being turned on unless the goggles are removed from their place on the wall.

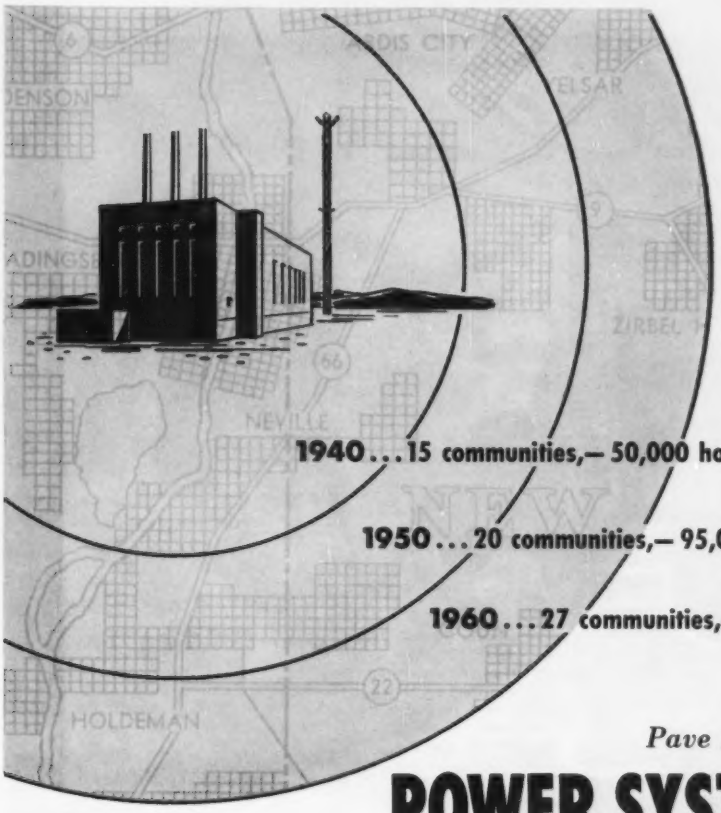
The grinder is turned off when the goggles are replaced.

A small "T" shaped plastic plate is fastened to the elastic band of the goggles. The stem of the "T" is pressed between two metal spring clips which are in series with the grinder motor. Each spring clip is in shape of a "U" with the curved portions against each other. When the "T" is removed, the spring clips make contact causing the motor to start. When the goggles are replaced, contact is broken.

There are two pairs of goggles available for the wearer using the grinder. One pair is clear, the other tinted. When either pair is removed, the grinder starts.

A toggle switch is also in series with the grinder within reach of the operator. This switch stays closed and is opened only in an emergency.

(More How To on page 174)


1940...15 communities,— 50,000 homes, businesses
1950...20 communities,— 95,000 homes, businesses
1960...27 communities,— 120,000 homes, businesses

Pave the way to

POWER SYSTEM GROWTH

with a modern communication system of your own

Collins MICROWAVE

Why fight the battle of burdened down communication lines. As your system grows, the greater your need for Collins microwave to keep operational costs in line. Although the initial investment is not small, it will pay big dividends in the years immediately ahead. And Collins microwave, with building block construction, is designed for low cost expansion to meet these future needs.

Collins microwave fulfills these needs reliably—

- Supervisory control
- Telemetering
- Automatic load control
- Facsimile
- Teletype
- Operational dispatching
- Private telephone circuits
- Remote VHF station operation
- High speed protective relaying
- General office accounting

Advanced engineering makes Collins microwave the most reliable, most flexible, easiest to maintain—

- **LONG-LIFE REFLEX KLYSTRON** provides reliable, low power, broadband microwave RF output.
- **HIGH GAIN ANTENNAS** and reflectors provide reliable propagation links at 6700 mc.
- **NON-CRITICAL IF AMPLIFIER** employs fixed-tuned filters to achieve 14 mc passband.
- **FREQUENCY DIVISION MULTIPLEX** provides flexible channeling without complicated or critical circuitry.
- **MECHANICAL FILTERS** provide reliable fixed-tuned channel selectivity with almost rectangular passband.
- **GROUP MODULATION** provides up to 120 Single Sideband Suppressed Carrier Channels. Meets high quality Toll standards.
- **OPTIONAL AUTOMATIC SWITCHOVER** to standby RF and standby common multiplex.
- **MAINTENANCE FEATURES** include built-in test facilities, articulated hinges, grasshopper fuses, fault alarm, and service channel.

Plan now to facilitate your power system growth

Collins engineers will study your problems. Advise you if a microwave system is the answer. Then, if so, submit an installation proposal. Write today for information.

COLLINS RADIO COMPANY

1930 Hi-Line Drive, Dallas 2, Texas
855 35th Street N.E., Cedar Rapids, Iowa
2700 W. Olive Avenue, Burbank, California
261 Madison Avenue, New York 16, New York
1200 18th Street N.W., Washington, D. C.
COLLINS RADIO COMPANY OF CANADA LTD.
11 Bermondsey Road, Toronto 16, Ontario

Pierce

QUALITY BRAND

UTILITY BODIES

• RUGGED • CONVENIENT • QUALITY •

Everything

YOU NEED IN A BODY TO GIVE YOU LOWER COST RESULTS

"SM"—Service Maintenance Bodies 74" to 104" long by 74" to 89" wide. Completely equipped with tool and parts storage for efficient operation.

"PLCC"—Combination Platform and Line Body with crew cab. Bodies of many different custom designs with or without crew cabs. Increases utility use of platform bodies with or without diggers.

"LC"—Line Construction Bodies with or without crew compartments. Fabricated for rugged use. Designed for efficient tool and parts storage and built to a high standard.

"SML"—Service Maintenance Ladder Bodies built to carry a ladder of your specifications. Complete with warning system and flashing lights. Compartment installations the same as "SM" Series Bodies.

"TT"—Transformer Trailer is one design of many for installation of transformer and circuit power. Transformer Trailers provide added capacity to restore service when secondary breakers trip repeatedly or transformers overload. This ingenious arrangement simplifies change-outs with fast service, anywhere.

"CMS"—Combination Meter Service Bodies 74" to 104" long by 74" to 89" wide. Transverse through compartment at front of body for carrying electric or gas meters. Capacity 12 to 36 electric meters or 5 to 16 gas meters. Two small parts drawers with removable dividers.

"CPT"—Cargo Pole Trailers of many designs and capacities. Single, dual and four wheel trailers built to your specifications.

Coupon for your convenience

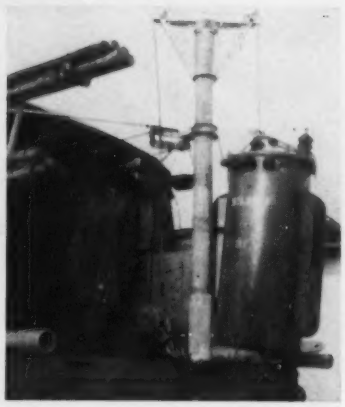
AUTO BODY WORKS, INC., 315 S. Pierce Ave., Appleton, Wisc.

Please send me more information on.....

Name .....

Address .....

City ..... Zone ..... State .....



LINE GIN can lift transformers up to 50-kva. Truck winch supplies power

Gin Lifts Transformers On or Off Line Truck

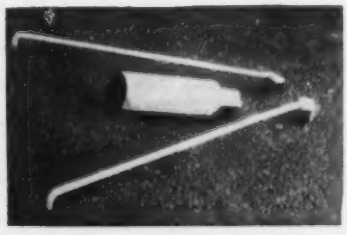
T. M. LACY, Clerk-Driver, Electric Dept, Sacramento Division, Pacific Gas & Electric Co, Rio Vista, Calif.

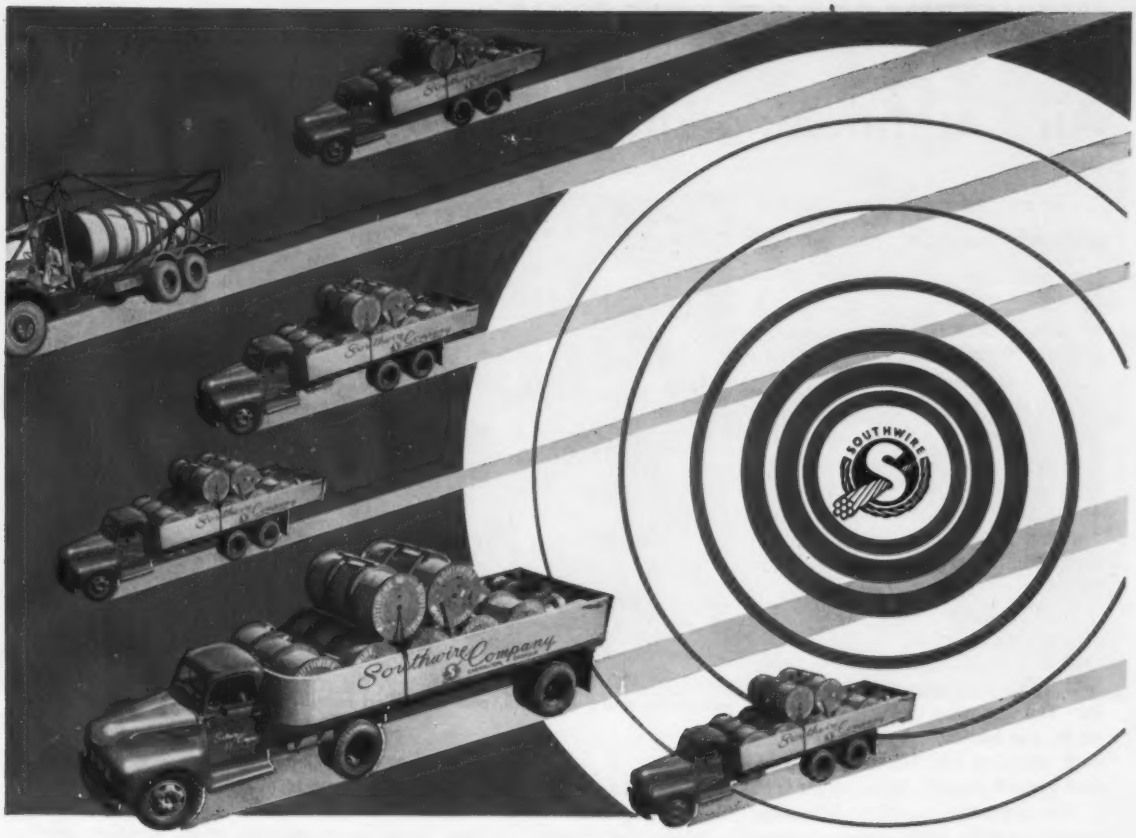
A transformer gin, used by Pacific Gas & Electric Co permits quick and safe handling of distribution transformers on or off trucks. Because the gin may be set up faster than a pole setting boom, it has proved very useful in handling large units.

The accompanying illustration shows the gin parts and their assembly. A pipe-base seat fits into a sheave socket at the back of the truck bed and forms a socket in which the gin pole base is set. Two adapters and steel braces hold the gin pole upright. Power for raising and lowering transformers from the truck bed is supplied by the truck winch.

The gin can handle transformers up to 50-kva capacity. It has saved time and labor on the Pacific G&E distribution system.

PIPE BASE SEAT fits into sheave socket on truck bed forming pole base socket





Southwire Trucks Make 1089 Trips and Cover 2 Million Miles a Year

To provide service on a par with Southwire quality

We learned a long time ago that, in this business, to win customers and keep them, service must be on a par with the quality of products. That's why Southwire operates its own fleet of modern trucks over a vast network—from Minnesota to Florida, from Pennsylvania to Texas. It is your positive assurance of dependable deliveries—direct to your warehouse or job site.

Southwire products are produced in our own modern plant to meet the most exacting requirements and specifications. Their quality is controlled from start to finish, checked and re-checked every step of the way, to give you the best.

Next time order Southwire products and get Southwire service automatically.

SOUTHWIRE PRODUCTS

- Bare and Weatherproof Copper and Aluminum Line Wire
- Neoprene Copper, Aluminum and Triplex
- Polyethylene Copper, Aluminum and Triplex
- Copperweld® Conductors
- Copper and Aluminum Building Wire
- ACSR and All Aluminum Cable
- Steel Guy Strand and Static Wire
- Aluminum Alloy Wire
- Cable Accessories

Southwire Company

Carrollton, Georgia • Terrace 2-6311

Air Conditioning Lifts Mushroom Yield 33%

. . . by extending the productive seasons through control of temperature and humidity

PAUL H. RICKERT, Industrial Sales Engineer, Metropolitan Edison Co, Reading, Pa.

Air conditioning is helping a Pennsylvania mushroom grower do a thriving, year-'round business by controlling temperature and humidity in a mushroom house. The growing season has been extended, and annual mushroom yield has jumped about 33%.

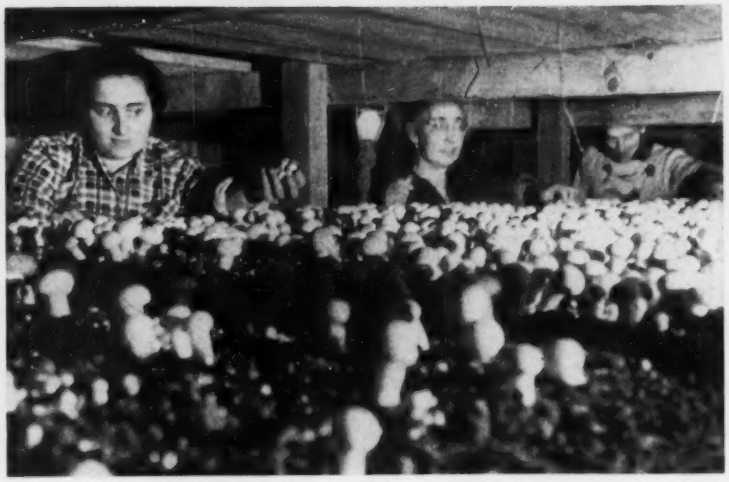
Nick Maggiaro, the grower, installed a packaged three- and five-ton unit in a single section of a double-unit mushroom house near Blandon, Pa. The first crop yielded 2¼ lb per sq ft. He harvested 7,000 basketsful, each weighing 3 lb. Formerly a square foot yielded about 2 lb.

The new setup has given Maggiaro control over his crop. Many growers consider 70F an ideal temperature for spawning and 60F for picking. Maggiaro now can produce those temperatures. Furthermore, he can delay spawning by lowering the temperature while other growers harvest. He can bring in his crop when competitors have none. He can ask premium prices. To keep mushroom surfaces dry, he can control humidity to help eliminate diseases and undesirable fungi growths.

Control of temperature and humidity pays handsome dividends. For example, Maggiaro reaped maximum yields when a sudden heat wave wiped out other growers' crops.

Maggiaro's dramatic experience with air conditioning in 1955 encouraged four more growers in the Reading area to put machines in their own houses. Ten others plan to follow suit in 1956 to insure their crops against failure, and to help them attain stabilized premium prices.

The units are used only to maintain optimum growing conditions when weather conditions become unfavorable. During 1955, they averaged 1,700 hours of service per unit. They were used to extend the spring crop season and to get an early start on the fall crop.



THICK STAND of choice mushrooms results from controlled temperature during spawning and harvesting, and controlled humidity to reduce chances of disease

Mushroom growing is tricky. Most growers try for three crops a year but usually get two and part of a third. They try to end the spring crop early in May and start the next in September. Premature or unseasonably late heat damages these crops. So growers talk about averaging "2½ crops a year."

Maggiaro successfully added air conditioning to insure a full spring crop and to get an early start in the fall. He had, in addition, a bumper output all year. He shut down for four weeks in July and August.

Others who got a late start in 1955 on air conditioning are hoping to realize four crops in 1956. Since three months is considered the minimum time for a crop—including time of replacing all dirt in the mushroom house—growers will require perfect indoor weather all 12 months to achieve this goal.

Such weather control would be exceedingly difficult without air conditioning. Packaged units provide an economical way for the grower to control these factors. Furthermore, the units are easy to install, economic to operate, and are dependable.

Chemical and physical reactions occur constantly in mushroom houses. This requires a good ventilating system capable of exchanging air frequently to remove the harmful corrosive gases produced by the mushrooms.

The problem of keeping gases from corroding the air conditioning was solved by Metropolitan Edison's sales engineers through exterior insulation, adequate filters, and ductwork made of durable Cypress wood.

PUT OUTSIDE, these 3 and 5-ton units exhaust corrosive gases of mushrooms

VICTOR PROGRESS REPORT 2

We make our own LIGHTNING to give you INSULATORS that last

Shown above is VICTOR'S 800,000-volt impulse generator in our modern electrical laboratory. This unit, together with VICTOR'S complete mechanical and electrical test facilities, enables our engineers to simulate the most extreme service conditions.

Included in this unit are a remote controlled gap spacing mechanism, an oscillograph for showing wave forms visibly on the screen of a cathode ray tube and a 4″ x 5″ camera for recording these waves on film for observation and study.

One more reason why VICTOR gives you insulators that last—that are design-tested to withstand lightning and other adverse service conditions. VICTOR'S modern plant, engineering and research facilities are unsurpassed in the field. You just can't buy better insulators!

"BETTER INSULATORS THROUGH RESEARCH"

SPECIFY VICTOR Purified Porcelain Insulators!

VICTOR INSULATORS DIVISION
I-T-E CIRCUIT BREAKER CO.
VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions • Guy Strains
Spools • Switch and Bus Insulators • Custom Designed Porcelain
Insulator Hardware

99.6% SURE
His health depends on continuous electric power . . . on the farm, in the dairy, in the home . . . to assure proper pasteurization and refrigeration of his milk. That's where C-D's field-proved dependability pays off . . . regardless of changing weather or power load conditions. The thousands of C-D power capacitor installations . . . all with records of 99.6% trouble-free service . . . have proven C-D BEST BY FIELD TEST in contributing to the high continuity of utility service. Consult C-D to learn how you can get more for your capacitor dollars with C-D.
CORNELL-DUBILIER CAPACITORS
consistently dependable for power-factor improvement
PLANTS IN SO. PLAINFIELD, N. J., NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS., PROVIDENCE AND HOPE VALLEY, R. I., INDIANAPOLIS, IND., SANFORD AND FUQUAY SPRINGS, N. C., SUBSIDIARY, RADIART CORP., CLEVELAND, OHIO

CORNELL-DUBILIER
power-factor
capacitors
give you better than 99.6%
trouble-free service*

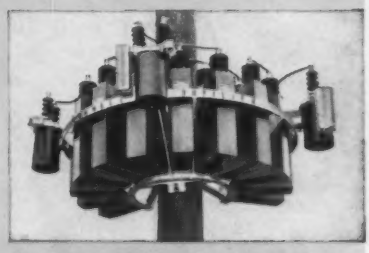
Lowest volts per mil unit stress results in the extra margin of safety necessary to withstand all system high voltage transients. This lower volts per mil and lower volts per section feature is the utility's assurance of extra longevity in its capacitor purchase when Cornell-Dubilier's are specified.

Only C-D power capacitors are subjected to a full-rated voltage energization test. C-D removes potential trouble-makers before they get on your poles . . . not after with costly replacements.

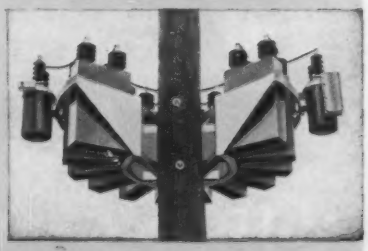
Lowest unit dielectric stress not only provides lowest voltage gradient for steady state operating conditions, but also highest withstand protection against the transients produced by lightning, circuit breaker re-strikes and all other line surges.

Heavy major insulation in the form of laminated liners, with reinforced corners insures highest impulse withstand levels. It means, too, a heavier capacitor unit . . . because it's a better unit . . . but at no extra cost to you. How would you relate a slight increase in weight to years of trouble-free service?

Why is it that only C-D power capacitors give you assurance of complete dependability?... because C-D's built-in safety factor results from the ultimate in tried and proven design levels coupled with conservative production techniques and rigorous quality control. For catalog write to Cornell-Dubilier Electric Corporation, South Plainfield, N. J.



C-D's new semi-round pole mounting Contour Capacitor® Rack.



***This is an average based on reports from leading utilities using C-D capacitors. Many of these reports have shown 100% trouble-free service, and none lower than 98.9%.**

More Applications

Flaw Spotter

. . . uses iron filings to detect imperfections in steel castings. Only good castings are machined

P. E. PETERSON, Power Service Engineer, Chicago North Div., Commonwealth Edison, Chicago, Ill.

Non-destructive testing of steel castings is accomplished at the Magnetic Inspection Laboratory Co in Chicago by magnetizing the castings and spotting the flaws by their effect on iron filings. Money thus is saved because faulty castings are rejected before final machining.

Partially machined steel castings are received at the laboratory. They are placed in the testing machine which resembles a lathe. The piece is magnetized either by passing the magnetizing current through the part, or by placing a small part in a solenoid. For the first method, 1,000 amp per sq in. of surface of the casting is used. For the other, eight ampere turns are used on the solenoid.

Kerosene and iron filings are then applied to the casting. With the casting magnetized, the iron filings seek the points of flaws.

Pieces that have bad flaws are rejected. Those with surface cracks are ground down to eliminate those flaws provided this can be done within the tolerance limits of the casting.

Detection of flaws before the casting has been completely machined eliminates costly machining operations on faulty castings.

Boosters End Low Voltage

Booster transformers helped Carpenter's Diner, Elmira, N. Y., and the New York State Electric & Gas Corp solve a low-voltage problem created by a service changeover from 230 v to 120/208-v underground. Some of the customer's all-electric kitchen equipment no longer heated properly. Boosters now jack up the voltage 10% on devices that could not be modified for 120/208 v. A. M. Kendall, Power Sales Engineer, NYSEG, Elmira, N. Y.

Tighten only 1 easy-to-reach bolt to install the CHANCE MONO-BOLT GUY GUARD

When a groundman installs a Chance Mono-Bolt Guy Guard, he has only three things to do:

1 Slip the flanged hook over the guy wire.

2 Place clamp on anchor rod and slide it into the slot at bottom of guard.

3 Tighten this one bolt at the *lower end of the guy guard.*

It's that easy—your men don't have to be extra tall—there's no stretching for high bolts to tighten . . . the Mono-Bolt clamp securely grips the anchor rod with a firm 3-point gripping action . . . only a single wrench is needed. Easy installation makes for proper installation.

Heavy gauge steel guard is hot galvanized for long life and high visibility.

Mono-Bolt Guy Guard comes in half or full round construction, in 7 and 8 foot lengths. Fits any size rod from ½" to 1¼".

CG56-9

A·B·CHANCE CO.

ABC INDUSTRIES

CENTRALIA, MISSOURI • San Francisco, Cal. • Pittsburgh, Penn.

INDUSTRIAL NEWS NOTES

New Word: Automotion

Blaw-Knox and General Electric engineers have created a driverless car to shuffle racks of transformers in and out of heat-treating ovens at the latter's Schenectady plant. Resembling a short flatcar on railroad type wheels, the vehicle is capable of motion in six directions, and is controlled by a complex programming arrangement. The car completes an automatic system of preheating, pressure-vacuum impregnating, baking, and curing of transformers.

•

Year Squeezer

New automatic electronic welding equipment has been developed that squeezes a year's production of vinyl plastic products into a month. It requires only supervisory attendants, reports Ivan H. Schwartz, Radio Receptor Co, Inc, Brooklyn, N. Y. This welder is designed to replace smaller-capacity 2-kw machines.

•

Fast Talk

Olson Transportation Co, Green Bay, Wis., put an RCA two-way radio system in its Chicago terminal. Company figures that the system effectively increases the Chicago fleet of 75 trucks to 85, and saves $10,000 a year in phone tolls from drivers who formerly called in for orders. Base station has 15-w output.

•

One Fell Swoop

Dow Chemical Co replaces fluorescent tubes at its Freeport, Texas, plant after using them 7,500 hr, even though they still burn. Cost: $1.50 per tube. Replacing lamps as they burn out costs $2.30 each. The saving is in labor. Group replacement will save $250 in one building alone in 1957.

•

Purse Strings Attached

When McLouth Steel Corp put individual motors on each roll of its mill tables, there were strings attached—purse strings. Motors should save $60,000 a year in lubrication costs by obviating main reduction and bevel gears on the tables. Motors also should pay for themselves by preventing in the future unscheduled shutdowns that resulted when the line-shaft drive broke down.

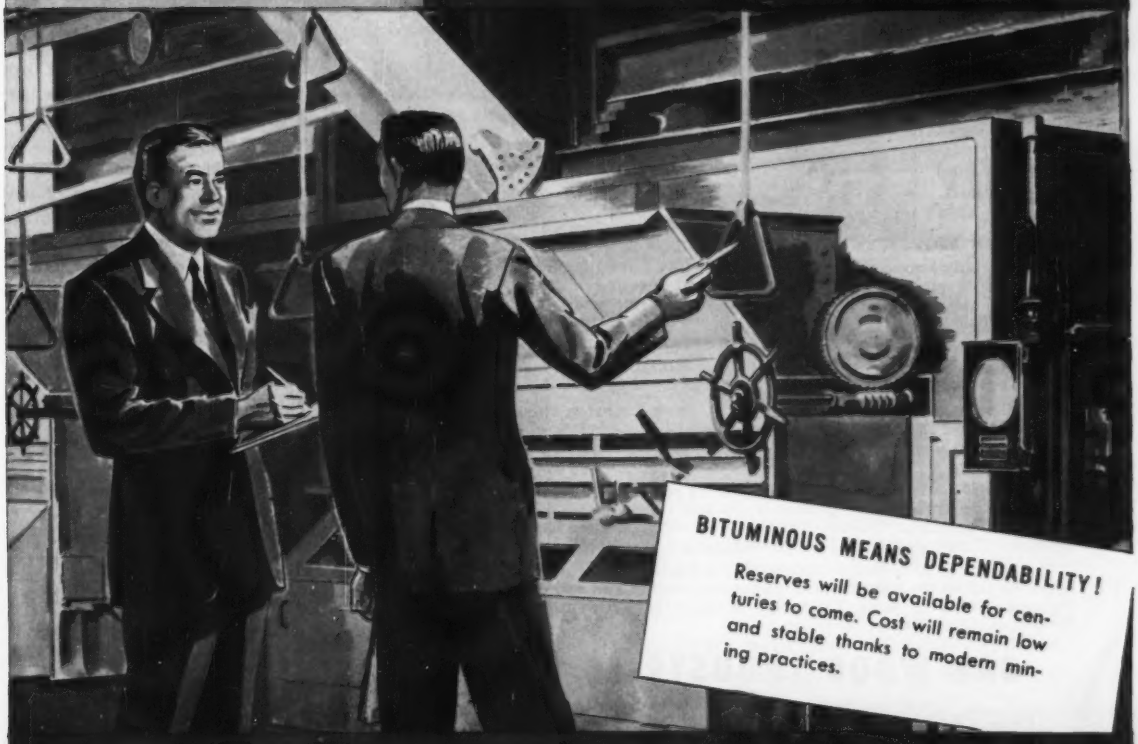
Are you now using the most efficient coal for your purpose?

LET OUR TECHNICAL SERVICE ADVISE YOU!

No two plants are alike—design and equipment characteristics make the difference. That's why it's so important to consider *kind* and size when selecting a coal for your particular burning equipment. The B&O Technical Service is prepared to study your specific problem and help you choose the correct coal. Here's what our service does for you:

- outlines Bituminous coals available for your plant.
- discusses the merits of these coals.
- establishes current and predicts future relative values of these coals.
- determines the best coal for your system.
- suggests the most efficient way to burn this coal.
- supplies case histories of actual savings in fuel costs.

Ask our man! Write:
COAL TRAFFIC DEPARTMENT
BALTIMORE & OHIO RAILROAD
BALTIMORE 1, MARYLAND



BITUMINOUS MEANS DEPENDABILITY!

Reserves will be available for centuries to come. Cost will remain low and stable thanks to modern mining practices.

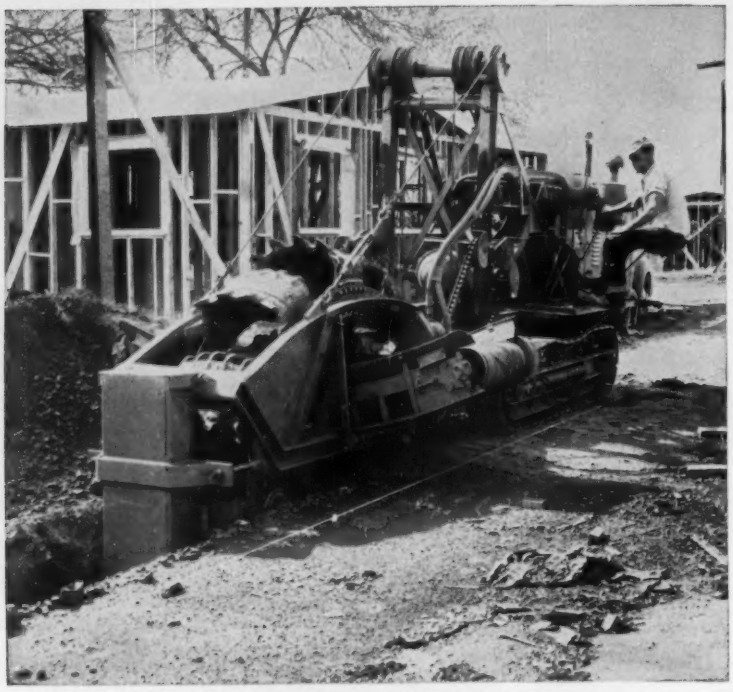
LINKED TO GREAT STATES WITH THE NATION B&O

Baltimore & Ohio Railroad

Constantly *doing things*—better!

BITUMINOUS COALS FOR EVERY PURPOSE

FASTER, MORE ACCURATE CONTROL FOR "Stop and Go" UTILITY DITCHING



ONLY Gar Wood Buckeye **HAS IT!**

Utility ditching requires frequent changes in travel and digging speeds for work in close quarters . . . frequent raising and lowering of digging wheel to protect existing pipe, cable and conduit. For "stop and go" work like this, Gar Wood-Buckeye's new job-proved 305 offers exclusive advantages:

Live hydraulic wheel hoist provides faster, more accurate positioning of the digging wheel, independent of all other operations. It's operated from the seat by simple, one-hand controls.

Hydraulic conveyor drive provides three discharge speeds in either direction . . . instant adjustment to handle any volume of spoil independent of any other function. No complicated shifting, no need to stop digging wheel or crawlers.

Track-type crawlers on the 305 let you dig regardless of ground conditions . . . tread lightly to protect lawns and sidewalks . . . last longer, cost less to maintain. Transmission is specially designed for "stop and go" operations...any travel speed can be obtained with any digging wheel speed.

The 305 digs to 5 feet, 6 inches deep; 12 to 24 inches wide in 2-inch steps. To get all the facts about this advanced ditcher, call your Gar Wood-Buckeye dealer, or write: Customer Service Department, Gar Wood Industries, Inc., Wayne, Michigan.

GAR WOOD INDUSTRIES, INC.

Wayne, Michigan • Findlay, Ohio

Plants in Wayne and Ypsilanti, Mich.; Findlay, Ohio; Mattoon, Ill.; Richmond, Calif.

Gar Wood Truck Cranes | Gar Wood Winches | Gar Wood-Buckeye Ditchers | Gar Wood Truck-Mounted Cranes | Gar Wood-St. Paul Hoists & Bodies

INDUSTRIAL BRIEFS

Handling and weighing wire coils at Jones & Laughlin Steel Corp's Wire Rope Div, Muncy, Pa., is now done by one man who runs a 30-kw conveyorized system using a special hoist, carrier, and cab. Wire coils are stored on pallets in special racks. When the operator gets an order for a specific wire, he hoists a pallet and carries it to the production area. The needed wire is removed and the balance is returned to storage. En route, the pallet is weighed automatically and tagged to show the weight of the wire remaining in the rack. Inventory is taken simply by reading the tags. The customer chose this system because it reduced storage space and labor, and speeded production. K. H. Breon, Industrial Representative, Pennsylvania Power & Light Co, Williamsport, Pa.

Obtaining accurate colors of labels lithographed directly upon tin can blanks is achieved with the aid of a fluorescent-incandescent light combination at Continental Can Co, Pittsburg, Calif. The three large presses require constant inspection, for when colors begin running together the presses must be cleaned. To obtain a maximum press run of high quality printing, several combination fixtures were installed over each press. Each fixture holds two 40-w blue fluorescent lamps, two 40-w daylight lamps, and four 750-w silver bowl incandescent lamps. The resulting light mixture enables inspectors to spot trouble immediately. The rest of the plant, also requiring good color renditioning, is lighted by deluxe cool white fluorescent lamps. L. R. Rowton, Lighting Engineer, Pacific Gas & Electric Co, Richmond, Calif.

SEND IN YOUR INDUSTRIAL BRIEF

You'll get a great deal of satisfaction from knowing that your item may help someone else with a similar problem. And you'll get a $5 honorarium too for each item accepted. Send us the basic facts covering the application; the name and location of user; benefits, advantages, and land characteristics of the application. Mail to: Industrial Editor, Electrical World, 330 W. 42nd St., New York 36, N. Y.

Wagner replacement core and coils come ready to install in your old tanks...

fully tested....thoroughly dried....packed in oil!

Obsolete or burned-out transformers needn't be consigned to the scrap heap. With Wagner Form W Core and Coil Replacement Assemblies, these transformers can be made good as new again... *and up-rated at the same time* because the new preformed cores are considerably smaller than the old cores. These packaged replacement core and coil assemblies are factory-new elements, exactly like those used in new Wagner Transformers.

They come to you fully dried and tested—ready for use—protected in a sealed container filled with Wagner 7-NI inhibited transformer oil which you may also use in your tank. They are available in ratings from 3 through 167 kva.

Installation is easy... the assemblies are complete with terminal board or tap changer, with leads ready to install in your tank. Each assembly has a new serial number and name plate.

Wagner Bushing Assemblies

High Voltage Bushing Assembly

Available in cover-mounted or tank wall mounted types to meet a wide range of requirements. Gasket, solderless connector-type terminal and clamping devices are included—fuses can be furnished when specified.

Low Voltage Bushing Assembly

Ready to install—includes porcelain bushing, gasket, solderless connector-type terminal and clamping device.

Field Repair Service for Substation Transformers

Wagner's Transformer Service Trucks—completely equipped for field repairs—each with the services of an expert—are available on schedule in most localities. The cost of this exclusive Wagner service is nominal—write for information.

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

Wagner Electric Corporation
EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

TS56-1

VEPCO Sets Area-Wide Program Showing . . .

How to Tell the 'Live Better . . . Electrically' Story

Using the national Live Better . . . Electrically program as a base for local action, Virginia Electric & Power Co kicks off on a comprehensive local LBE promotion on April 8.

The utility, 12th largest in the nation, will tie-in with key appliance dealers, distributors, contractors, builders, realtors, and architects to tell the LBE story in VEPCO's service areas.

Use Newspaper Supplements

Hefty newspaper supplements which the company has arranged with major newspapers in Richmond, Norfolk, and Newport News will appear April 8, 9, and 11. They will include about 30% free editorial coverage plus VEPCO's center spread, two-color ad promoting appliances, wiring, and better electrical living.

Major electrical manufacturers and local dealers and distributors have been contacted for editorial and advertising support.

Blanket Area with Radio Spots

When the newspaper supplements break, the company will begin a special three-week saturation radio campaign in the same cities. Twenty and 60-second spots will sell the LBE aims.

Elsewhere in the system, the utility will feature ads in 93 newspapers used regularly every week. Its regular system-wide radio show, the VEPCO Weathergram, also will use the LBE theme throughout. These five-minute spots will promote use of appliances, adequate wiring, and low cost benefits of electricity.

Help Consumers, Trade Allies

As an added inducement for trade allies, three company divisions have been designated the LBE team: the home service staff, builders' representatives, and dealer sales representatives. These three units will work in each district with consumers and trade allies to spread the idea. They will cover everything from appliance demonstrations and classes to technical aid in drawing up modern wiring layouts for contractors, architects, and builders, and giving sales training classes for appliance dealers.

Boost Employees' Enthusiasm

Coinciding with VEPCO's trade ally work, its employees will be informed about LBE by an eight page handbook. The book will be distributed and will also run as a center spread insert in the company magazine.

Residential and Commercial Sales Director C. E. Anderson says the electrical trade allies are enthusiastic and optimistic about the success of the LBE program. And enthusiasm for it is running high throughout the company, VEPCO spokesmen say.

VEPCO's starting point for teamwork plans with trade allies was pegged on the Feb. 8 closed circuit telecast from New York. At meetings in Richmond and Norfolk, trades people learned the LBE objectives and were shown how to capitalize on both the local and national campaigns.

Explain Tie-in Potential

Complete LBE kits containing nationally prepared materials and VEPCO's forthcoming ads were given to each visitor. Also included was a special instruction sheet which outlined the company's local campaign plans and explained in detail how to tie-in with the program for maximum benefits.

Trade allies who didn't attend the LBE television meetings will receive colorful flip card presentations telling the program's entire story. In some locations, a kinescope of the telecast will be used along with flannelboard presentation.

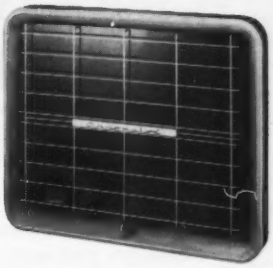
Housewares Distributors Ask Manufacturer Help

Price reductions and other recent trends in the marketing of electrical housewares has spurred the nation's electrical distributors to find new ways to lower their costs of doing business.

Arthur W. Hooper, executive secretary of National Association of Electrical Distributors points out that with today's high cost of doing business, and fixed expenses, the areas in which a distributor can reduce his costs are limited. He said it is incumbent upon the distributor's supplier to cooperate with him in every way in reducing these costs. Speaking in Chicago recently he called upon manufacturers to accept a few suggestions developed by NAED'S Electrical Housewares Committee. Among them:

- Reduce the distributor's burden in cooperative advertising—let the manufacturer and dealer cover the costs and the distributors administer the activity.
- Improve packaging and labeling of cartons to allow easier and more efficient warehousing of merchandise.
- Alleviate the distributor's costly handling and rehandling of items requiring repairs and service through "spot replacement" and similar programs now being used by some manufacturers.

(*More S&S on page* 186)



RADIANT WALL PANELS

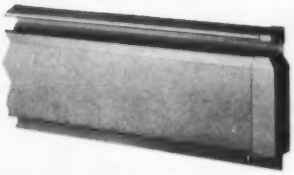
in two attractive color-combinations, modern styling to blend with any decorative scheme. *All-Metal*, completely sealed, metal enclosed tubular element. Break-, moisture-, and shock-proof. No back insulation required; no moving parts. Completely factory-assembled for easy installation. Optional built-in adjustable thermostat for fully-automatic use.

FAN-DRIVEN WALL INSERT HEATERS

pack a lot of heat into a small space. Separate switch sets heater in automatic operation without disturbing thermostat setting. Chromalox heating element is moisture-proof, break-proof, and safe. Sepia Brown grill and beige front cover blend with any decorating scheme. 1½" projection from wall and air seal prevents leakage and dirt streaks along the wall surface.

CEILING THERMWIRE

hidden in the ceiling offers one of the most satisfactory ways of providing comfort heating for modern living. Specially constructed and insulated cable, completely covered, gives noiseless, draft-free heat. Use anywhere—either new or remodeled homes—on plaster or dry wall construction. Individual thermostats can be used to control the temperature of each room.



BASEBOARD HEATERS

use the famous Chromalox strip heater proved in more than 35 years of rugged industrial service. Installs fast—2 screws hold it—2 wires connect it. Four lengths fit any wall. Blanks, corners, and trim complete custom-tailored installation. Paint to match any color scheme. Two-heat construction available for modulated output. Puts the heat where losses occur, eliminates cold floors.

RADIANT BATHROOM HEATERS

are designed especially to provide comfort and safety in bathrooms. Fits between wall studs. Meets FHA standards. Metal sheathed heating element gives absolute safety from shock. Attractively styled, modern in appearance. High radiant heat, without moving air, to warm you as you step from shower or tub.

For the truly all-electric home . . .

CHROMALOX ELECTRIC HEATING UNITS

Chromalox . . . First Name in Electric Heat . . . announces a complete line of quality Electric Home Heating Equipment. Behind the Chromalox name are 39 years of experience in the design, manufacture and application of electric heating equipment for home and industry. This exacting craftsmanship is front line support for your load building in today's most promising electrical market, in building compensating winter load. For full details, write for a copy of the Chromalox Electric Heating Products Guide.

CHROMALOX — FIRST NAME IN ELECTRIC HEAT

Edwin L. Wiegand Company

7513 Thomas Boulevard, Pittsburgh 8, Pa.

B-915

STOP weeds all season

Just one application of "Telvar" controlled weeds around this fence. Note the type of vegetation involved in untreated area in the foreground.

Spray just once with Du Pont TELVAR®

WEED KILLERS

When you use "Telvar" weed killers, vegetation is killed through the roots, and regrowth is prevented because the chemical remains in the soil . . . provides residual action all season long. And low dosages (1 to 1½ lbs. per 1,000 sq. ft.) make it cost little for the results you obtain. Such low rates also mean less handling, less use of storage facilities.

"Telvar" weed killers come as wettable powders, are non-corrosive, non-flammable, non-volatile, low in toxicity to humans and livestock.

Include "Telvar" weed killers in your weed-control program this year. Prove to yourself how these products of Du Pont research can help cut your maintenance cost to new low levels.

Where brush is a problem, Du Pont Ammate® X weed and brush killer is the product you need. It kills more kinds of brush with unusual safety. With ordinary precautions, "Ammate" X may be used close to such crops as cotton, tomatoes, soybeans and peanuts.

• • •

FREE ILLUSTRATED BOOKLETS describe how to control weeds and brush with Du Pont chemicals. Write to Du Pont, Grasselli Chemicals Dept., Rm. D-4032, Wilmington, Del. In Canada, Du Pont Company of Canada Limited, 80 Richmond Street West, Toronto, Canada.

DU PONT
REG. U.S. PAT. OFF.

On all chemicals, follow label instructions and warnings carefully.

WEED and BRUSH KILLERS

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

Jump Sales 45%

"Wheel of Fortune" such a smash that Southwestern Public Service plans '56 repeat

"Wheel of Fortune", Southwestern Public Service Co's unique dealer salesmen campaign worked so well last year that the company is going to try it again.

In ten month's time salesmen chalked up a record of $593,000 in appliance sales over and above the campaign's goal of $3.5 million (EW, Sept. 19, 1955, p 208). Together they sold 13,457 units of four appliances—ranges, water heaters, dryers and freezers—to push volume 45% above a like period in 1954. Water heaters were the biggest sellers with a 140% increase; ranges next with a 100% jump.

The "Wheel of Fortune" idea aims at getting the salesman to own each of the four appliances as well as to sell them. A non-owner receives a $20 bonus for selling one of each of the four appliances, whereas an owner gets double that amount.

This year's campaign, which runs from Feb. 1 to Nov. 30, will be changed somewhat from the first one. It will concentrate more on promoting each of the four appliances during its favored selling season. Salesmen will be paid in July for all bonuses earned before June 30, and another payment will be made in December to cover the last half of the campaign.

Gas Firms Try to Win Back California Electric Users

Growing popularity of electric built-in appliances and all-electric homes in housing developments in southern California has prompted local gas companies to try to win the public back to all-gas homes.

Under new extension rules filed with the California Public Utilities Commission, free length allowances will be decreased materially to new homes which are equipped with a minimum of gas equipment. The proposed order entirely changes allowances to subdividers and tracts and provides added allowances only when

(*Continued on page* 188)

Connect
COPPER with COPPER
ALUMINUM with ALUMINUM
use...

PAC-3
ACSR 6—1/0 Cu. 8—1/0

PAC-3
ACSR 8—2 Cu. 8—2

PAC-4
(formerly PAC 6—0)
ACSR 6—1/0 Cu. 6—2

PAC-7 (replaces PARC 6—0)
ACSR 1/0—336.4 / 6—1/0 A/R Cu. 8—1/0

BLACKBURN COPPER TO ALUMINUM FITTINGS

BLACKBURN PAC CLAMPS

ELIMINATE CORROSIVE SOLDERS, VOIDS AND FLUXES !

There are many satisfactory copper connectors for connecting copper conductors.

There are many satisfactory aluminum connectors for connecting aluminum conductors.

Blackburn's PAC clamps combine the features of a good copper connector and a good aluminum connector to give you the best copper to aluminum connector available.

Our exclusive method (Patent applied for) of pressure casting molten corrosion resistant aluminum alloy around specially treated pronged copper liners establishes an intimate, low resistance contact of the two metals without using corrosive solder.

The copper liners, which cannot be mated incorrectly, surround the copper conductor establishing a good copper to copper contact.

The aluminum grooves surround the aluminum conductors, establishing a good aluminum contact.

Adequate contact surface and conductor separation is built into Blackburn's PAC clamps to insure long-lasting, trouble-free copper to aluminum connections without setting up cold flow or galvanic corrosion.

Spring action is inherent in the design of PAC clamps and is supplemented with an extra-heavy spring lockwasher insuring permanently tight connections which will withstand temperature fluctuations.

Hot dipped galvanized steel hardware is standard. Aluminum hardware available on all but Catalog #PAC-3.

AVAILABLE THROUGH ELECTRICAL WHOLESALERS EVERYWHERE

JASPER BLACKBURN CORPORATION

35 MADISON STREET • ST. LOUIS 6, MO. • PHONE: MAin 1-2821

A Completely NEW

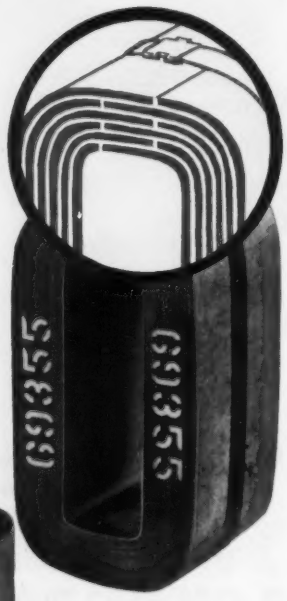
WOUND-CORE

FOR DISTRIBUTION TRANSFORMERS

BY R T & E Co.

A COMBINATION OF THE ★BEST CORE FEATURES

- ★ LOW LOSS
- ★ LOW EXCITING CURRENT
- ★ LIGHT and COMPACT
- ★ PERMANENT CHARACTERISTICS
- ★ EASY TO RE-ASSEMBLE



BETTER BECAUSE!

Because R T & E's NEW CORE is made of grain-oriented cold-reduced steel, without joint bulges—Low losses and low exciting currents are combined in a light compact core.

Because R T & E's NEW CORE has staggered butt-joints, lap secured on each side– Gap growth is eliminated, performance characteristics stay permanent and the core stays quiet.

Because R T & E's NEW CORE is made of single-turn loops of laminations — the core can easily be taken apart and put together again without special tools for maximum repair benefits

R T & E Co.

WAUKESHA WISCONSIN

the builder agrees to install all-gas appliances, particularly built-in equipment.

The new rules will replace the present plan whereby gas companies have been charging $55 per lot for gas service to new homes which are nearly all-electric. First commission hearing was held in Los Angeles on Feb. 17. Gas companies were asked to prepare for a later hearing on a comparison of extension costs under the old and new rules.

Mass Cooling?

Texas experiment shows air conditioning is possible for low-cost housing

Air conditioning is not too costly to be included in low-cost housing.

This is the report of Ned A. Cole at the recent convention of the National Association of Home Builders in Chicago. Cole is director of an NAHB research team which has been making comparative studies of 44 homes in Austin, Texas. Half the homes were equipped with air conditioning, half without.

He said that operating costs for both heating and cooling in the 22 air conditioned homes averaged $112.93 per home for a 12-month period, or $9.41 per month. This included 5,558 kwhr per home for air conditioning at 1.62¢ per kwhr and 33,333 cu ft of gas for heating at .06¢ per cu ft.

What this year-round comfort cooling and heating means to families who occupy the homes was disclosed by Cole in another statement to a Chicago newspaper. Said he:

"With air conditioning our report shows more couples, and more families with either young or teen-age children, spent more hours together as a family group than did the non-air conditioned families. They also ate more meals together.

"It meant easier household chores, better sleeping, less irritation, fewer nasal ailments, more home entertaining, an increase in women's club activities, and a weekly saving of $5.85 which otherwise would have been spent to find relief from the heat.

"The study found that the most

(*Continued on page* 190)

Ozone didn't K.O. this cable!

shock-tested for 6000 hours

U.S. ROYAL MASTER power cable still stands up!

Amazingly better than *any* of the five leading brands tested!

United States Rubber Company technicians tested U. S. Royal Master Power Cable against 5 leading competitive brands. Here's the test, and the results:

A sample of 5 KV unshielded U. S. Royal Master Power Cable and 5 other competitive cables were each bent into a U-shape, roughly 8 times overall diameter. Placed upright on a grounded metal plate, a conductor-to-plate potential of 40,000 volts was applied. All 5 competitive cables failed within 20 minutes to 35 hours. The U. S. Cable was still going strong after 6000 hours!

No other cable approaches U. S. Royal Master in performance and economy. Order cable from your distributor or write Electrical Wire and Cable Dept., United States Rubber Company, Rockefeller Center, New York 20, N. Y.

Adequate Wiring can be the two most important words in your manufacturing economy. Obsolete wiring can cause power failure, increase maintenance expenses and reduce your production. Make sure your present wiring is not only adequate for today's power needs, but also sufficient to carry the ever-increasing electrical loads required in your future growth.

US RUBBER

Electrical Wire and Cable Department

United States Rubber

Why did "Electrical World" study call Commercial Cooking *"The utilities' poor little rich load"?*

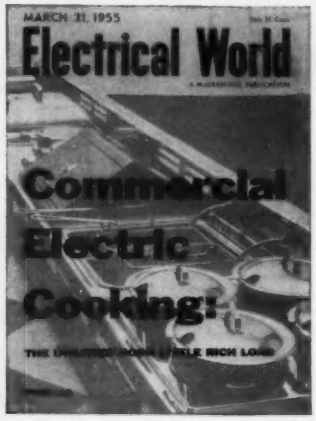
Write for this revealing study today—a profit story that light and power company executives can't afford to miss!

Frankly, we have never seen a more complete, more factual study of how Commercial Electric Cooking affects light and power companies. It was made by ELECTRICAL WORLD, backed by the reputation of that publication for accuracy and thoroughness.

The magazine's editors wanted the facts. Utilities across the nation were surveyed, and in the 12-page study that resulted from this thorough search for facts, 43 of these companies who are "cooking up big sales" tell you how they do it.

Here are some of the startling facts the study reveals:

- The food-service industry is nation's 4th largest, and expects to double annual sales to $35 billion by 1970.
- Each food-service operator represents potential load of 30 Kw.
- Commercial cooking brings in $23 per Kw in Estimated Annual Revenue—up to $690 added EAR per eating place.
- To get $1.00 in new revenue from Commercial Cooking, average utility surveyed spends just 32.2¢.
- Leaders in field are adding new load per customer at rate of 3 Kws and more yearly—yet for most part Commercial Cooking is "*Utilities' Poor Little Rich Load*," a lucrative market waiting to be tapped.



There are case histories, too—filled with information that can be applied in your own territory. Top executives tell the facts in their own words. President Charles E. Oakes of Pennsylvania Power & Light Co., for example, reports revenues of $2 million, saying: "Since 1946 we have added approximately 87,800 Kw of commercial electric cooking load. We estimate our annual revenue from this load to be in excess of $2 million."

To get your copy of this revealing report without cost, have your secretary write to us today for study entitled: *Commercial Electric Cooking—Utilities' Poor Little Rich Load*. It will be mailed to you promptly. For the answers to specific questions, please communicate with any of the member companies listed below.

COMMERCIAL COOKING EQUIPMENT SECTION
National Electrical Manufacturers Association • 155 East 44th Street, New York 17, N. Y.

ASSOCIATED PRODUCTS, INC. • CORY CORPORATION • GRISWOLD MANUFACTURING CO.
HOTPOINT COMPANY • MARKET FORGE CO. • ROYCE L. PARKER, INC.
SAVORY EQUIPMENT, INC. • THE SILEX COMPANY • STAR MANUFACTURING CO.
TOASTMASTER PRODUCTS DIVISION McGRAW ELECTRIC COMPANY
WELLS MANUFACTURING CO. • EDWARD L. WIEGAND CO.

comfortable living conditions were with the temperature between 76 and 79 F, the air in motion, and the relative humidity 50%. Humidity only became a problem when it varied sharply between extremes."

S&S SHORTS

RAPP Still Pulls

RAPP continues to sell electric appliances for Arizona Public Service Co, Phoenix. During 1955, 1,251 employees of Public Service bought 1,591 appliances through the company's Reddy Appliance Purchase Plan (EW, June 28, '54, pg 110). Total retail value of the appliances amounted to $209,336, an average of $232 per employee. RAPP sales are financed through the company and are made through established retail appliance dealers in the Public Service area.

Electric Heating Booklet

"Electric Heating Users Guide," a 20-page booklet describing home heating in general and and costs and types of electric house heating in particular, is available from the Westinghouse Electric Corporation. It is written for architects, consulting engineers, and electric utility and contracting personnel. For a copy write Westinghouse, P. O. Box 2099, Pittsburgh 30, Pennsylvania. Ask for booklet B-6709.

COMPETITOR'S CORNER

Gas Water Heater's Best Year

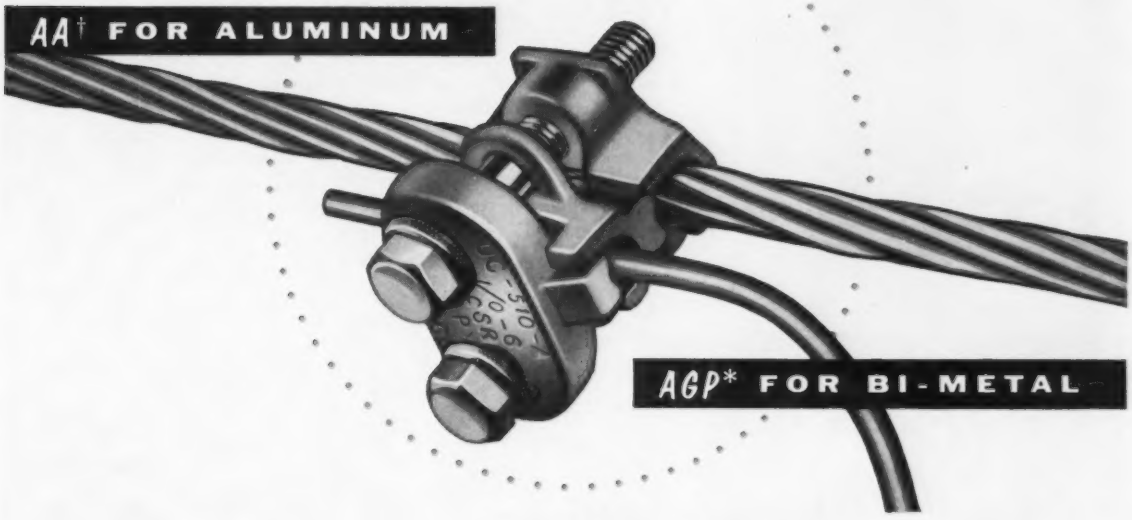
Gas water heaters had the best year ever in 1955, says Gas Age magazine. Shipments up to Dec. 1 reached 2,559,800 units, a 21.1% increase over a year earlier. On the other hand, electric units sold 900,000 units for all of 1955.

Other Gas Sales

Other gas appliance statistics were reported by American Gas Association Pres Dean H. Mitchell in his year-end report. Sales of gas clothes dryers were in excess of 350,000 (compared with 1,085,500 electric), and gas ranges (exclusive of built-ins) totaled 2,280,000 (vs 1,600,000 electric).

CHANCE UNICLAMPS

for easy-to-make connections



Stock only two types for all conductor combinations — al to al, al to cu, cu to cu, or cu to al

This new Chance aluminum body Uniclamp is available uncoated for all aluminum connections, or with a coating of high-density Chance FORTIFIED cadmium—just like that used on AGP Tap Clamps—for all-purpose connections. Clamp body construction speeds installation since the clamp will not come apart — there's no danger of dropping loose bolts. The tight-fitting contact surfaces will withstand hundreds of high-temperature heat cycles to protect the conductor under surge conditions.

Chance Uniclamps come in 1/0 and 4/0 ACSR sizes and are suitable for all distribution service, light transmission service and loop dead-ending. These connectors are part of the *complete* Chance line which offers a wide variety of clamps and connectors to meet every need. See your Chance Distributor, or write A. B. Chance Company, Centralia, Missouri, for full information.

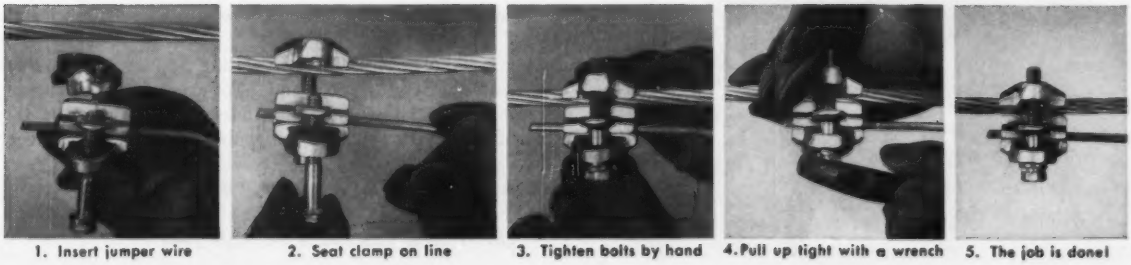
† Aluminum to Aluminum. * Aluminum General Purpose.

ABC INDUSTRIES

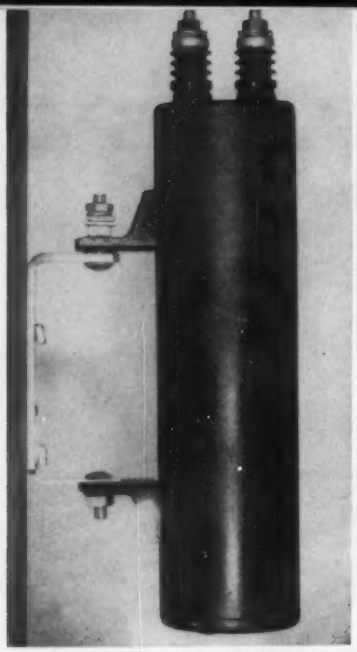
A·B·CHANCE CO·

IT'S EASY TO INSTALL CHANCE UNICLAMPS

CC56-10



1. Insert jumper wire
2. Seat clamp on line
3. Tighten bolts by hand
4. Pull up tight with a wrench
5. The job is done!



7½-Kvar Secondary Capacitor

This 7½-kvar, single-phase, 240-v capacitor is designed for power factor correction on secondary distribution circuits. It has 23½-in. overall height and 5-in. diameter.

Features of the capacitor include: Solder-sealed bushings; two 48-in. insulated leads; steel tanks protected by aluminum-metalized finish and alkyd-resin paint. The unit can be mounted with bushings up or down. A two-hole bracket is furnished for direct-pole mounting, or an EEI-NEMA bracket for crossarm mounting.

Line Material Co, Milwaukee 1, Wis.

Braidless Side-Break Switches

High-pressure on-center contacts and low-friction swivel terminals are featured in a line of braidless side-break switches. The line consists of single-break, center-break, and double side-break switches.

PMB-40 single-break switch (illustrated) is rated from 7.2 to 161 kv; 400, 600 and 1,200 amp; standard fault ratings. PM-42 center-break switch has ratings from 7.2 to 230 kv; 600 and 1,200 amp; standard fault ratings. PM-40 double side-break switch is rated from 69 to 330 kv; 600, 1,200 and 1,600 amp; standard and heavy fault ratings.

Delta-Star Electric Division, 2437 Fulton St, Chicago 12, Ill.

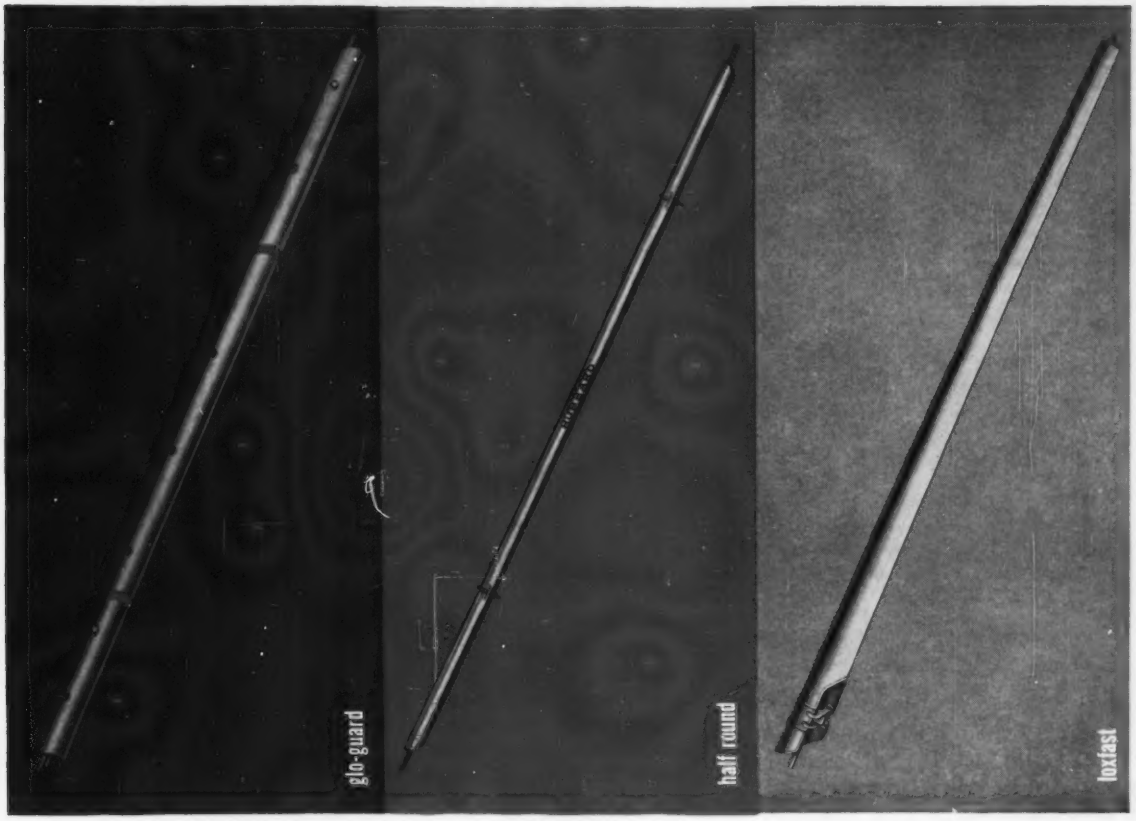
Thermal Relay

Type TRO-1 thermal relay with an overload indicating dial can be used on all types of power transformers. It combines overload protection with automatic starting of cooling equipment. The device consists of a bimetallic element, a relay, and a 5½-in. indicating dial with two pointers. It is mounted in an oil-tight well in the transformer wall with relay and dial projecting.

A yellow pointer continuously indicates operating position of the relay relative to zones of unsafe operation and also expresses a reference reading in "percent thermal load." A red "maximum" indicator is resettable and registers the yellow pointer's highest attained position since last resetting.

Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.

(*More New Equipment on page* 194)



on guard!

Hubbard Guy Protectors are designed to meet the requirements of maximum safety, visibility and shock resistance. Like all Hubbard Hardware, they install quickly, give years of service and have low replacement costs.

The next time you order Pole Line Hardware, check your Hubbard Catalog Number 60. More than 300 Hubbard distributors throughout the United States are ready to serve you.

GLO-GUARD—Two bright red reflective strips give maximum visibility day or night. Glo-Guards are formed from 18 gauge Cor-Ten steel that has a much greater resistance to corrosion and withstands impact to a greater degree than carbon steel.

HALF ROUND—Gives top protection under the most rugged service conditions. Extra rigidity is assured by the turned-in edges. U-Bolt clamping is designed to fit either strand, rod or clamp.

LOXFAST—Installs by tightening one bolt on the bottom clamp. The top clamp is fitted to the guy wire by a clip arrangement. Heavy gauge, double-dipped galvanized steel makes for extra strength, high visibility.

QUALITY! FOR MORE THAN A CENTURY

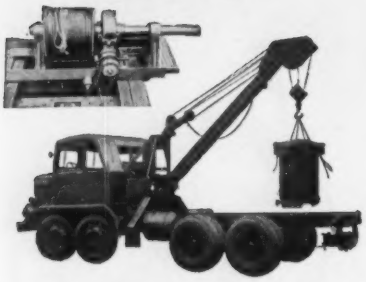
Secondary Racks • Wireholders • Pole Seats and Balconies • Braces • Drive Hooks • Wood Strain Insulators • Clevises • Extension Arms • Long Span Hardware • Pins • Clamps • Guards • Stubbing Bands • Guy Protectors • Guy Clamps • Pole Struts • Clips • Straps • Hangers • Carriage Bolts • Lighting Standards • Lighting Brackets • Eye Bolts • Pole, Corner and House Brackets • Guy Hooks • Strain Plates • Lags • Machine and Hubeye Bolts • Sidewalk Guys • Autogap Lightning Arresters

HUBBARD AND COMPANY

Pittsburgh 1, Pa.
Chicago 50, Ill.
Oakland 8, Calif.

Utilities Have Specified
SILENT HOIST Equipment
• Since 1918 •

KRANE KAR Swing-Boom Mobile Crane: for materials-handling . . . lifting, transporting, positioning, gasoline or Diesel, 1½, 2½, 5 and 10 ton capacities, 9 to 37 ft. booms (or telescopic booms), solid or pneumatic tires. Self-stabilizing without jacks or outriggers; unobstructed vision; fast, flexible, safe, easy to operate.



WINCHES: Capstans; Single and Double Drum, Jaw Clutch, Keyed and Friction Clutch Winches. 2,000 to 50,000 lb. Capacities.

SWING-BOOM CRANES: Truck: Motor Power Operated; high capacity; takes up only a small space. For handling transformers, cable reels, lamp posts, trees, poles, manhole castings, etc. 9 to 31 ft. booms; one to 10 ton capacities.

TOWERS: 2 or 3 section type and Pantograph types, with plain, revolving or racking platforms.

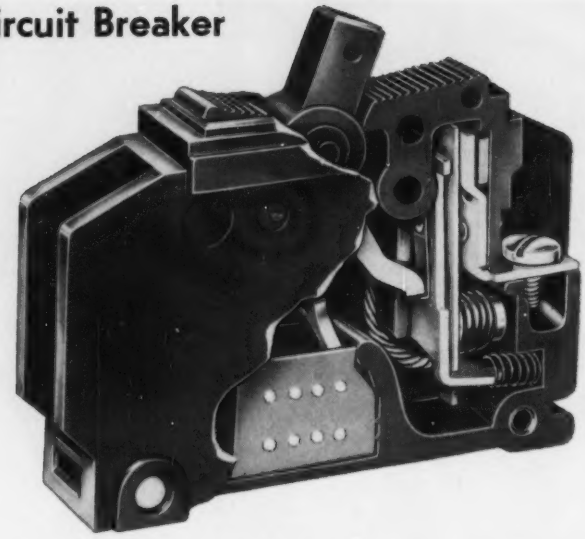
TRIPOD POLE DERRICKS: for 35 ft., 45 ft., and 60 ft. Poles; single piece or telescopic side legs; removable cast steel fittings.

USERS: AT&T; N. Y. Tel. Co.; T.V.A.; Consolidated Edison Co.; W.U.; Municipalities throughout America.

WRITE FOR CATALOGS:
No. 79—KRANE KAR *No. 70—Truck Equipment*

THE ORIGINAL SWING BOOM MOBILE CRANE WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER
2½, 5, AND 10 TON CAPACITIES
KRANE KAR
TRADE MARK REGISTERED
SILENT HOIST & CRANE CO.
862 63rd ST., BROOKLYN 20, NEW YORK

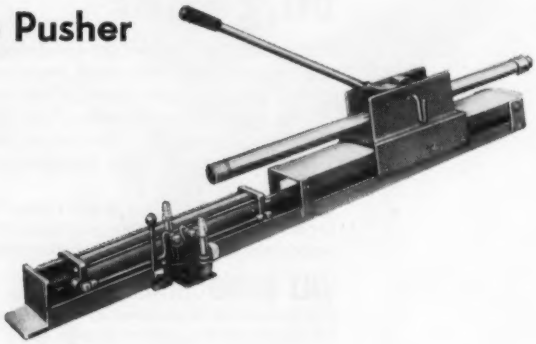
Circuit Breaker



This ambient compensated Quicklag circuit breaker is designed for 120-v ac lighting and power distribution panels. It acts with added speed to protect circuit wiring and eliminates tripping due to ambients from 30 to 140F. These features result from a ten-times-rating magnetic trip for short-circuit protection, so the 15-amp breaker trips magnetically at 150 amp.

Other design features include: Quick-make, quick-break action; bolted-type connections; and inverse time limit overload bimetal action. The line is available in ratings of 15, 20, 30, 40 and 50 amp.
Federal Pacific Electric Co, 50 Paris St, Newark 1, N. J.

Pipe Pusher



A portable hydraulic conduit and pipe pusher incorporates simple design and one-man operation. No hand labor is required other than installation of the machine.

The standard model, known as Speed-Thru, handles conduit up to 3 in. To indicate the product's speed, manufacturer cited a case in which the machine pushed 2-in. pipe beneath a 73-ft wide highway in 18 min with no drift deviation.

The unit is said to push or pull conduit with equal speed. Its hydraulic power unit is driven by either electrical motor, truck power, or gas engine.
Mercury Hydraulics, Inc, 2440 Blake St, Denver 5, Colo.

(*More New Equipment on page* 196)

WHY BUY LESS THAN YOU ALWAYS GET WITH

FARGO "5000" SERIES

VISE-TYPE CONNECTORS*

TOP EASE and speed of application! Maximum conductivity contacts! Strong, vibration-proof mechanical joints! Ready availability for re-use! You get all these advantages — everything that's important — with Fargo (5000 Series) "One-Piece" Vise-Type Connectors.

These connectors are available in corrosion-resistant bronze and plated bronze. Your distributor can furnish them in all sizes from #8 solid copper to 100 MCM inclusive.

EASY AS 1, 2, 3 !

1 — Hook on run

2 — Insert tap

3 — Tighten bolt

* Patented

ASK YOUR LINE MATERIAL ENGINEER FOR COMPLETE DETAILS

Manufactured by

FARGO MFG. COMPANY, INC.

Poughkeepsie

New York

FARGO

Distributed by

LINE MATERIAL COMPANY

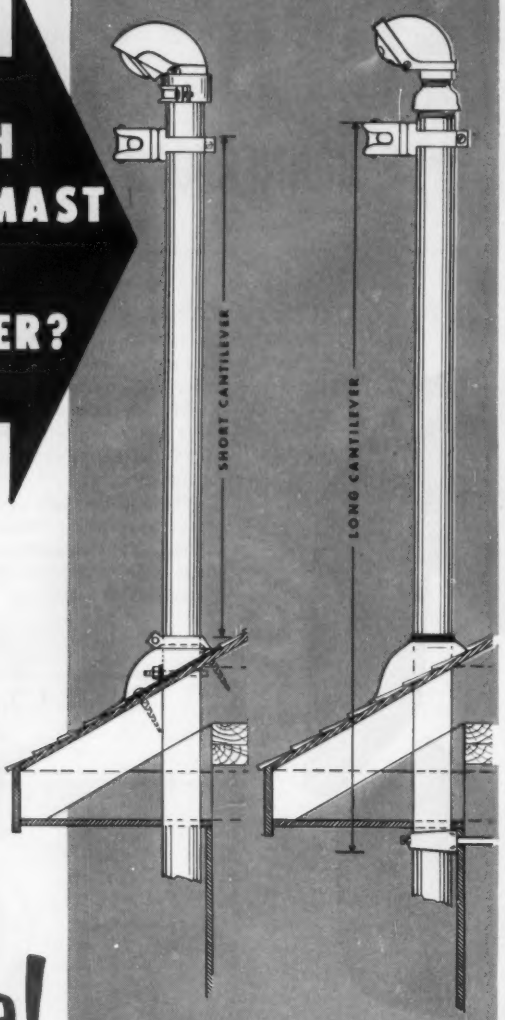
(A McGraw Electric Company Division)

Milwaukee, Wisconsin

In Canada, CANADIAN LINE MATERIALS LTD., Toronto, Canada

WHICH SERVICE MAST IS STRONGER?

Series 2075 Of Course!



SERIES 2075 MAST KIT

MAKE-SHIFT MAST

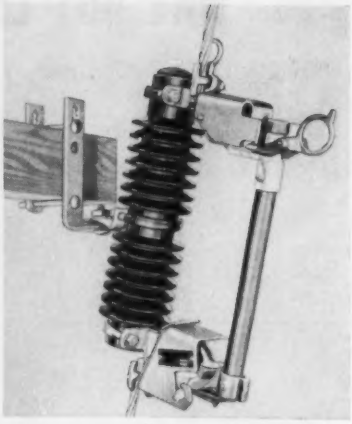
Porcelain Products service mast kits make possible strong, safe, trouble-free mast installations. The exclusive Roof Mounting Plate anchors the mast at the highest possible point (roof level) on the strongest possible framing (the rafters).

Porcelain Products Mast Kits are complete in every detail . . . eliminating sloppy, make-shift installations. For complete details . . . write today!

ELECTRICAL PORCELAIN SINCE 1894

62 years Porcelain Products, Inc. PP INC

FINDLAY, OHIO



Open-Type Cutout

Interchangeable fuseholders are featured in this open-type drop-out cutout (Type F). The fuse mountings and fuseholders are available individually, and fuseholders of the same ampere and voltage ratings can be used interchangeably. By installing a new fuseholder, the cutout can be converted to any interrupting capacity rating.

The Type F cutout is available in 5.2, 7.8 and 15-kv ratings at 100 and 200 amp. The 100 and 200-amp fuse mountings are the same except that heavier contacts are used in the latter.

A contact conversion kit is available for converting the 100 and 200-amp fuse mountings. Expendable caps can be obtained for doubling the interrupting capacities of certain fuseholders.

Maximum interrupting capacities range from 2,000 to 12,000 amp for regular cutouts and from 2,000 to 10,000 amp for loadbreak cutouts.

A. B. Chance Co, Centralia, Mo.

Induction Heating Line

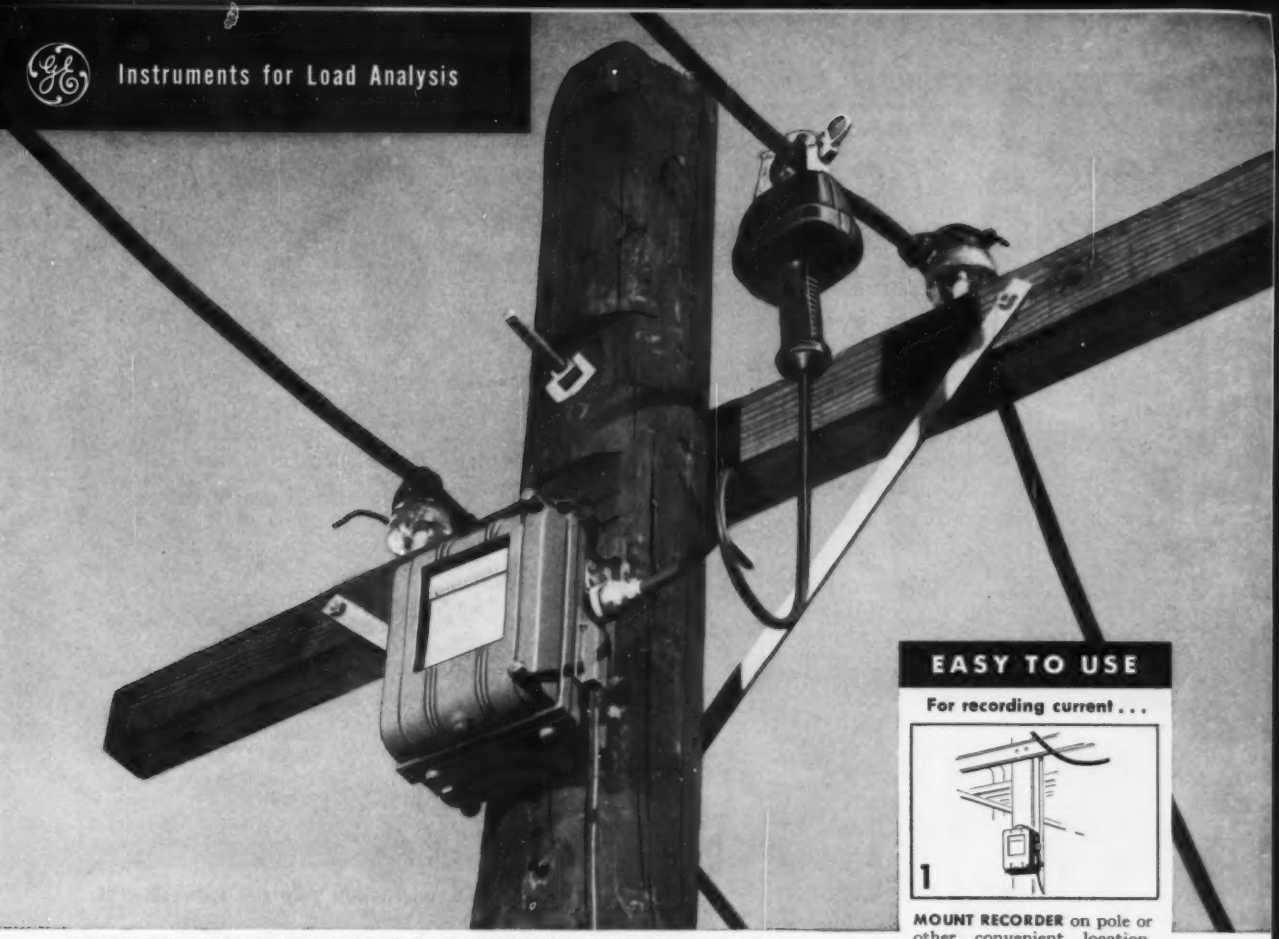
A line of induction heating equipment has been expanded to include 960, 3,000 and 10,000-cycle low-frequency motor-generator units.

The new units, available in sizes from 30 to 1,250 kw, are particularly suited to brazing, case hardening, and through heating for forging and melting applications. The units augment a line of high-frequency (450 kc) induction heaters.

Allis-Chalmers Mfg Co, 932 S. 70th St, Milwaukee 1, Wis.

(*More New Equipment on page* 198)

Instruments for Load Analysis



GENERAL ELECTRIC RECORDER HAS HOOK-ON TRANSFORMER ASA RATED TO 8700 VOLTS

Here's an Easy Way to Help Solve Coming Electrical Load Problems

G-E inkless recorder allows fast hook-on installation; can operate continuously for 30 days without attendance

FOR LOAD ANALYSIS, the General Electric CF-7 hook-on recorder provides an easy way to obtain accurate records of electrical loads. This versatile instrument can measure and record either current or voltage without interrupting service. Fast, convenient, hook-on installation and the ability to operate continuously for 30 days without attendance make the recorder ideal for checking growing commercial and industrial loads.

INSTALLATION of the lightweight, portable instrument for recording either current or voltage requires only four simple steps. (See explanation at right.) Once the recorder is installed, little servicing is necessary other than replacing record rolls. Inkless recording means that there are no messy inkwells to clean. Weatherproof for dependable outdoor use, the recorder can operate accurately in a wide range of ambient temperatures. You can use the CF-7 recorder in any one of seven ranges: 15/75/150/750 amperes, a-c; and 150/300/750 volts, a-c. The butyl-molded hook-on transformer is ASA rated up to 8700 volts and the transformer secondary is short-circuit protected for operating safety.

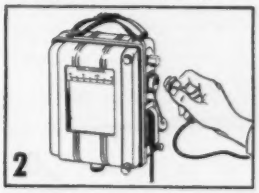
SEE FOR YOURSELF how the General Electric CF-7 hook-on recorder can help solve coming electrical load problems. Write Section 582–14, General Electric Co., Schenectady 5, New York, and ask for bulletins GEA-6104 and GEC-215, or contact your nearest G-E Apparatus Sales Office.

GENERAL ELECTRIC

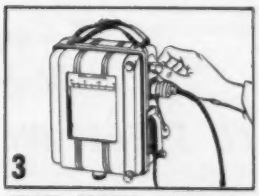
EASY TO USE

For recording current . . .

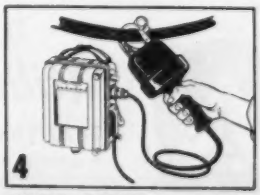
MOUNT RECORDER on pole or other convenient location. Connect recorder to either 120-volt or 240-volt power supply (50 or 60 cycles).



CONNECT TRANSFORMER LEAD to special socket on the side of the recorder.



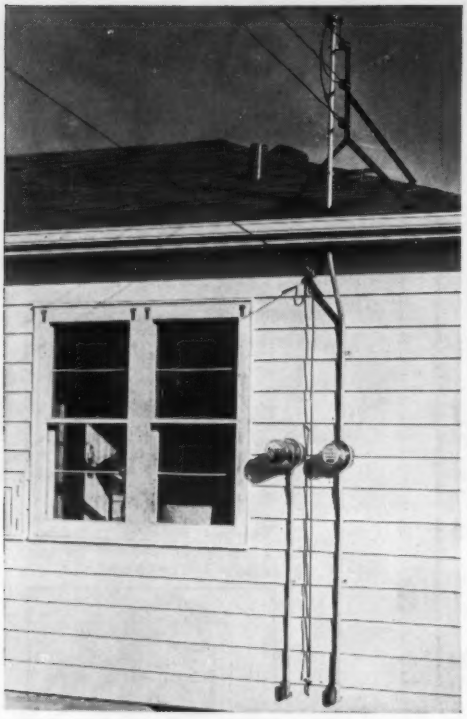
SELECT PROPER RANGE by setting selector switch for 15, 75, 150, or 750 amperes.



HOOK CURRENT TRANSFORMER on the conductor which is to be checked.

here is the answer . . .
TO YOUR SERVICE ENTRANCE MAST PROBLEMS . . . . . .

MITI-MAST®



PRESENTS THE NEW P-1081-B ROOF MAST

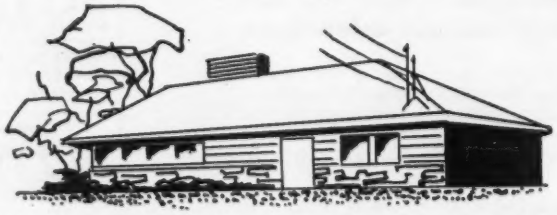
•

No other mast offers . . . permanent anchorage — 3-point suspension — complete security in all kinds of weather for interruption-free service.

1000 pound line loading

Also featuring . . . easiest installation — no large hole necessary — adjusts to any roof — accommodates EMT, rigid conduit, or service entrance cable — adaptable to both new and old construction.

★ Fully Insured against damage by product failure, personal liability, and property damage.



ALL STEEL WELDED CONSTRUCTION . . . ECONOMICAL

ALL THIS FOR ONLY $7.95 *(Contractor's Price)*

If your local jobber cannot supply you, write to us direct.
• The only company in the world whose facilities are devoted entirely to providing the industry with better Service Entrance Masts.
"WE BUILD SAFETY."

MITI-MAST

Utility SERVICE COMPANY, INC.

1620 Thirteenth Street, Racine, Wisc.

Producers of Service Entrance Masts, Temporary Service Masts, Outdoor Telephone Booth Service Masts.

Copyright 1956

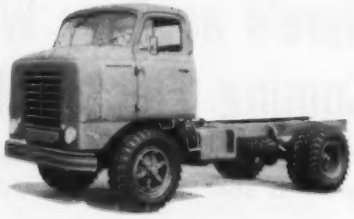
Brute Transformer Gin

This heavy duty gin is designed for hoisting heavy loads. Manufacturer claims that it will handle the heaviest of equipment intended for mounting on a pole structure.

Design tests reportedly show that the gin has a safety factor of 3 to 1 when raising 2,500 lb with two double blocks. Manufacturer warns that a snatch block must be installed at base of pole to prevent twist and minimize stress on structure.

The product (Catalog No. 5742-22) weighs 31½ lb. Its foot casting is concave to conform to the curvature of the pole.

Bodendieck Tool Co, Taylorville, Ill.



Cab-over-Engine Trucks

This cab-over-engine design is featured in a 1956 line of 12 trucks. All models have four-wheel drives in gross vehicle weight classifications of 14,500 to 40,000 lb.

The trucks are designed for utility line construction and maintenance and similar tasks. They vary in horsepower from 131 to 240 and have from four to 12 transmission speeds depending upon the model.

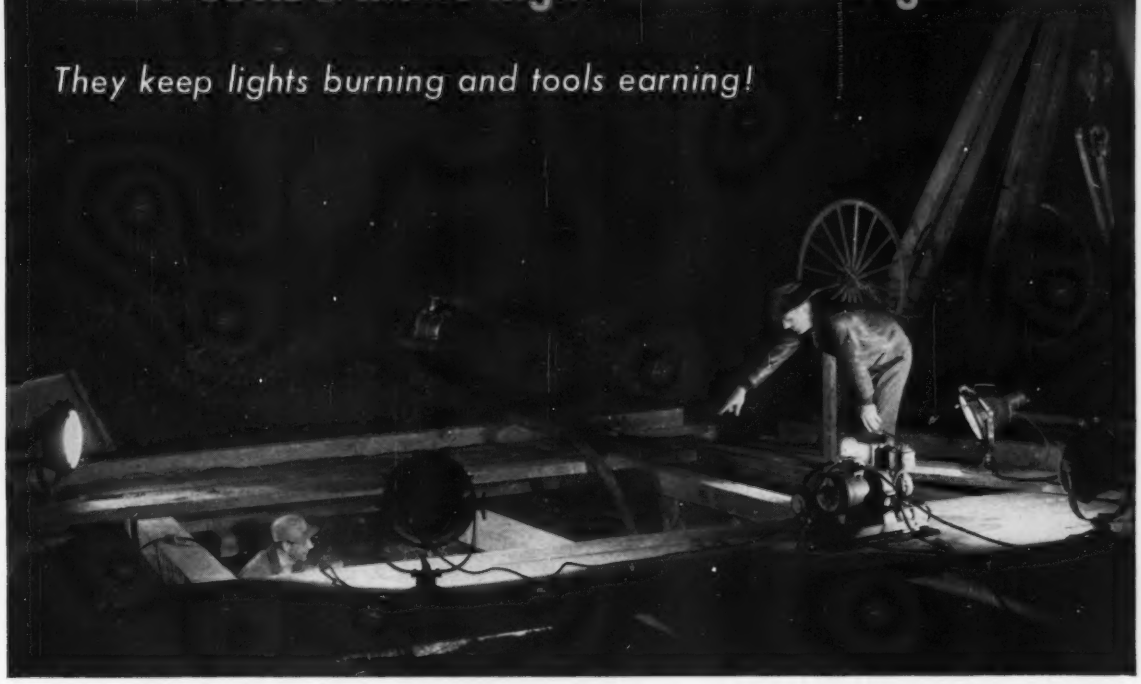
The cab-over-engine style is available for special six-wheel-drive applications.

Four Wheel Drive Auto Co, Clintonville, Wis.

(*More New Equipment on page* 200)

TIREX CORDS make night work into bright work

They keep lights burning and tools earning!



Emergency overtime work requiring portable electric saws, drills, lights, etc., is almost always work that must be done in a hurry. Such work must not be delayed by cord, tool or equipment failure.

Think, then, of the result of a failure of portable cords attached to floodlights. The job stops until adequate light is provided, but wages continue on at overtime rates. When thousands upon thousands of dollars and the successful completion of a rush job depend upon portable cords, why quibble about a few pennies extra cost? Why not get the best and know that your job will be finished on time?

TIREX cords are tough cords. They will take abuse that would wreck most ordinary cords and they'll come back for more. This toughness is the result of the cured-in-lead Selenium Neoprene Armor, an exclusive TIREX feature.

The next time you've got a job that really requires cord stamina, use TIREX. You will be pleased and happy that you did. You can get most sizes of TIREX from your local electrical distributor's stock. Just insist on getting genuine TIREX.

Simplex

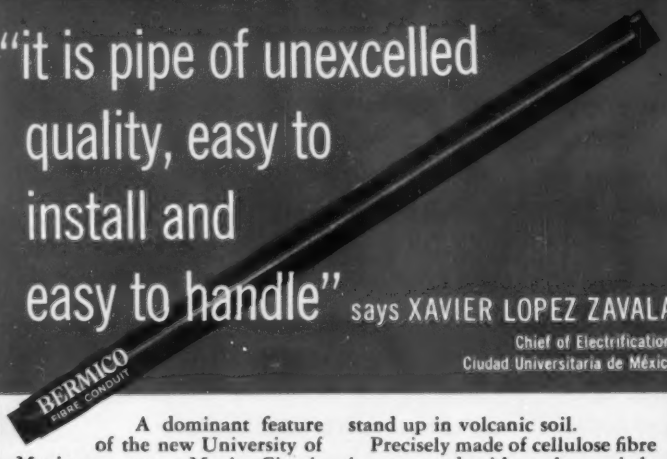
TIREX CORDS AND CABLES *are made only by the*

SIMPLEX WIRE & CABLE CO., 79 Sidney St., Cambridge 39, Mass.

BERMICO® electrical conduit was installed here because.....

"it is pipe of unexcelled quality, easy to install and easy to handle" says XAVIER LOPEZ ZAVALA

Chief of Electrification,
Ciudad Universitaria de México



A dominant feature of the new University of Mexico campus, at Mexico City, is the Library pictured above. Because the campus is built on an ancient lava bed, care had to be exercised in selection of underground materials. That Bermico conduit was used to carry the underground electrical wiring is testimony to Bermico's ability to stand up in volcanic soil.

Precisely made of cellulose fibre impregnated with coal tar pitch, Bermico Conduit is both acid- and alkali-resistant, as well as light, tight, strong, and uniform from end to end—yet low in cost.

For lasting protection of underground wiring systems specify Bermico. Immediate shipment of all sizes and fittings.

Distributed by WESTINGHOUSE Electric Supply Company
Offices in principal cities

BROWN COMPANY
Berlin, New Hampshire
GENERAL SALES OFFICE: 150 CAUSEWAY STREET, BOSTON 14, MASS.

Finishing Compound

A gray finishing compound, known as Plaskote, is designed for use on non-metallic sheathed cable and service entrance cable.

The compound is said to be flame and moisture retarding and to have good stability and processing qualities. It is a thermoplastic resin treated to produce a smooth uniform finish.
Industrial Chemical Co, Taunton, Mass.

Deadend Thimble

A cast aluminum thimble is designed for use with the preformed type of deadend. The thimble is rated 12,000 lb and will accommodate deadends for conductor through 336.4 MCM.

Thimble's groove is flat to fit the eye of the deadend. The pulling eye simplifies stringing techniques, and ample clearance is provided between the ears and between the bottom of the groove and clevis pin.
Bethea Co, Inc, P. O. Box 1407, Birmingham, Ala.

Fiberglass Hot Stick

A fiberglass hot stick telescopes from 4½-ft length to 28 ft. Claimed to be completely non-conductive, the tool weighs less than 7 lb.

Hooks, wrenches, saws, brushes and other tools and accessories can clamp into the business end of the hot stick.
Orchard Industries, Inc, Hastings, Mich.

(*More New Equipment on page* 202)

Compare pole top appearance!

KPF Switches

modern functional attractive

KPF Air Break Switches look different because they are different. Their pole top appearance is neat and uncluttered. There is a "straight-through" cleanliness of line—the visual appeal of design simplicity.

With this simplicity goes operating dependability and long life. There are no delicate mechanisms to malfunction, freeze, lock from cross-arm warping, need lubrication or wear out. This same simple construction also saves weight. KPF phase units weigh about the same as a comparable insulator stack. Double cross-arms and extra bracing are not needed. Installation is faster and less expensive.

KPF Switches have proved themselves in nearly a half century of major system operation. Why not get the details and make a test installation.

For catalog and complete specifications, write direct

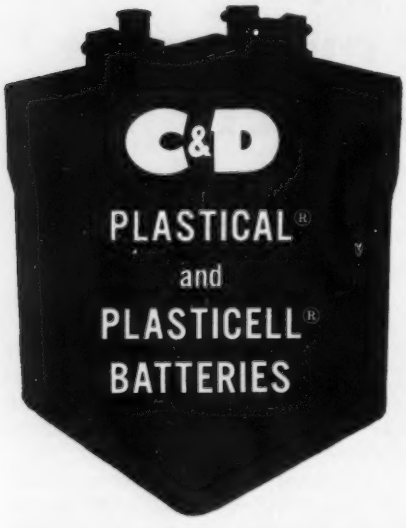
KPF ELECTRIC COMPANY

Dept. E, 1624 E. Alpine Avenue
Stockton 5, California

KPF
AIR BREAK SWITCHES
Standard for nearly half a century

Now—"engineered" power

for switchgear-control —emergency lighting —auxiliary power



Compact, modern-design "power plants" engineered for specific applications! C & D PlastiCals and PlastiCells give you completely dependable power—*where power must not fail!*

PlastiCal—with lead-calcium grids for maximum life—is conservatively engineered for at least 25 years in full-float service. PlastiCell—with high-tensile alloy grids—has a projected life of 14 years in float service.

WITH BOTH PLASTICAL AND PLASTICELL YOU GET SUCH ADVANCED C & D DESIGN EXTRAS AS:

1. Extra-long life—exclusive design combines advantages of both suspended and supported plate construction.
2. Triple insulation—thick Fiberglas mat, microporous separators, and perforated Koroseal retainer.
3. Saftee-Vent—outstanding C & D development that prevents accidental battery explosions.
4. Crystal-clear plastic jars—heat-resistant and hermetically sealed.
5. Plastite Post Seals—for easier maintenance, and at the lowest lifetime cost.

Write for C & D Specification Bulletins:
CP-536 Rev. 1 on PlastiCal Batteries
CP-537 Rev. 1 on PlastiCell Batteries

C&D BATTERIES, INC.
of Conshohocken, Pa.
Industrial Batteries since 1906

SALES AND SERVICE OFFICES IN PRINCIPAL CITIES FROM COAST TO COAST

DC Volt Ammeter

Main features of this portable dc volt ammeter are: Relay protection against overload; plug-in-type shunts and series resistors; and flexible whip-type pointer.

The unit (Model A) is reportedly fused and accurate within 0.5%. It is available with one or 40 ranges from 10 ma to 25 amp and 15 mv to 250 v. It has full scale sensitivity of 200 ohm per v.

Sendur Mfg Co, 3225 N. Sheffield Ave, Chicago, Ill.

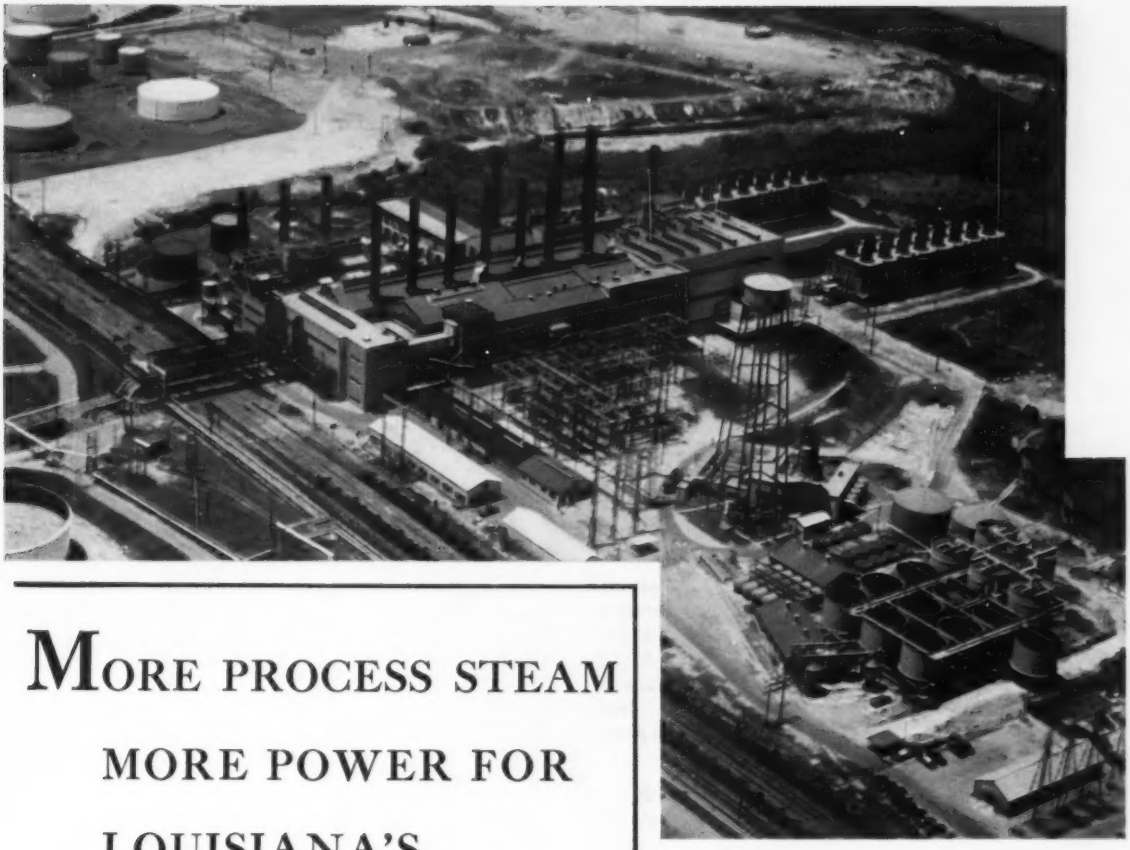
Corona Test Set

Manufacturer claims that a self-contained and non-destructive unit enables simple and accurate corona testing. Triple-range kilovoltmeter at output terminals is provided.

Standard sets are available from small portable units to large sets of up to 100-kva capacity and in voltages up to 30 kv. Special units up to 80 kv can be made.

Peschel Electronics, Inc, 15 Garden St, New Rochelle, N. Y.

(*More New Equipment on page* 205)



MORE PROCESS STEAM MORE POWER FOR LOUISIANA'S INDUSTRIES

Louisiana Station, situated north of Baton Rouge, was the first large plant designed to utilize oil refinery residues for as much as one-third of its total fuel requirements.

Louisiana Station of Gulf States Utilities Company was designed and built by Stone & Webster Engineering Corporation in 1930. With an initial capacity of 1,500,000 pounds of steam per hour and 45,000 kilowatts, it was one of the first utility plants to generate electric power as a by-product of the large scale supply of process steam for industry.

To supply the additional requirements of the oil refinery which was its original customer, as well as those of new industries attracted to the area which utilized both process steam and electric power, Gulf States through the years has engaged the Corporation to design and build new units. The most recent addition, just completed, brings the total capacity of the plant to about 6,750,000 pounds of steam per hour and 406,000 kilowatts.

If you have a problem of design or construction, our broad experience in these and related fields may help you solve it. Write or call us for complete information on our services.

STONE & WEBSTER ENGINEERING CORPORATION

AFFILIATED WITH E. B. BADGER & SONS LIMITED (LONDON)

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Seattle Toronto

Here is the lamp that made reflector cleaning obsolete

NOT SO LONG AGO, the frequent cleaning of lamp reflectors presented a major factory-maintenance problem, especially in heavy industry areas. Dirt, grease and smoke on reflectors actually cut down valuable working light.

Today, thanks to the development of the R-52 "high bay" lamp by Sylvania engineers, reflector cleaning is no longer necessary. This new high-output incandescent lamp has its own aluminized reflector *sealed inside the glass envelope*, making it 100% dirtproof.

Making the reflector an integral part of the lamp improves its efficiency, too—and assures the "just-right" angle to concentrate a clear, bright light directly on work surfaces below. You get more usable light for the same wattage.

Sylvania manufactures R-52 Reflector Lamps in 500- and 750-watt sizes. For complete information, contact your Sylvania Supplier, or write directly to:

SYLVANIA ELECTRIC PRODUCTS INC.
Dept. 6L-2803—Lighting Division
60 Boston St., Salem, Mass.
In Canada:
Sylvania Electric (Canada) Ltd.
University Tower Building, Montreal

SYLVANIA

. . . fastest growing name in sight

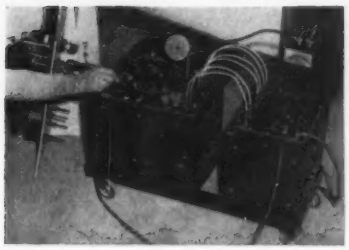
LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

Fault Finder

A fault finder is designed to monitor industrial control circuits continuously and to indicate faults instantly in any one of six monitored circuits. Manufacturer reports the fault finder requires no warm-up time, is electrically isolated from monitored circuits, and utilizes printed circuits and standard electronic components for minimum maintenance.

Key component of the product is a cold-cathode gas-filled tube which blocks current flow until its starting anode is energized; current flow ceases when current to its main anode is interrupted. Circuitry of the fault finder is designed so that current flows to the indicator lamp so long as the main anode circuit is not interrupted.

In operation, each monitored circuit has a signal lamp which remains lighted as long as the circuit is trouble-free. If a fault occurs, the lamp is extinguished and remains so until the finder is manually reset. This feature assures detection of momentary faults and makes the unit a fail-safe device. **Westinghouse Electric Corp, P.O. Box 2099, Pittsburgh 30, Pa.**



Test Instrument

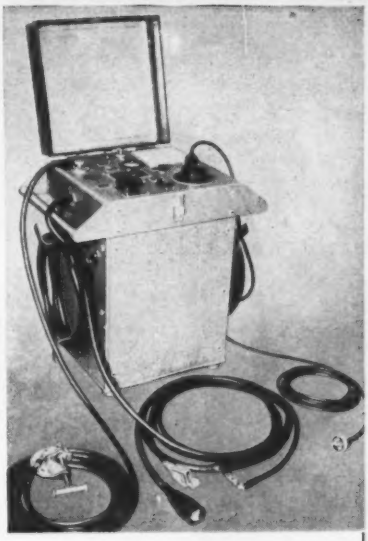
Model IDR-35/2 is capable of testing, calibrating and coordinating induction disc relays, current transformers, and related devices.

The instrument is a high current transformer with a tapped series reactor in its output circuit. It is designed for safely running simulated trip-time and coordination tests at outputs to 4 kva.

The unit is adjustable in overlapping steps through continuous duty ranges of 0-160 v at 0-25 amp and 0-10 v at 0-200 amp.
Multi-Amp Corp, 10 Third St, Newark, N. J.

(More New Equipment on page 207)

BIDDLE *Instrument News*



BIDDLE IMPULSE CABLE FAULT LOCATING TRANSMITTER

Model 5, 5 KV, 16 MUF

Those companies operating an appreciable amount of 600 volt cable should be particularly interested in this recently developed transmitter. Those having cable in the 2500 volt delta and 4000 volt wye insulation class will also find this transmitter well suited to their needs for proof testing and locating faults on important circuits. Similar applications include the proof testing and location of faults in drag cables such as used with electric shovels in strip mines. Still other applications include extensive lighting circuits such as used at airports and in highway lighting.

BIDDLE IMPULSE CABLE FAULT LOCATOR EQUIPMENT NOW INCLUDES:

Model 3, 25 KV, 1.65 MUF
Model 4, 15 KV, 2.00 MUF
Model 5, 5 KV, 16 MUF

Model 2 Detector for use with each of the Transmitters

Model 1 High Voltage Bridge and other accessories

Write for **Bulletin 65-W.**

BIDDLE DIELECTRIC TEST SET MODEL 1-40 KV

—for measuring d-c current at voltages up to 40 kv when applied to the insulation of such equipment as generators, transformers, bushings and cable.

Carefully considered safety features, excellent output voltage regulation, simple operation, compact design, and facilities for making voltage and current measurements at either polarity have been incorporated in this test set.

The set has a current rating of 25 milliamperes at short circuit, and current measurements can be made down to 0.5 microamperes which is the first division on the microammeter.

Overall dimensions are: height 19½ in., width 13½ in., depth 20 in., weight 120 lbs. All high voltage components are oil immersed.

For complete details, description, specifications, and prices, write for **Bulletin 22-W.**

James G. Biddle Co.
1316 Arch St., Phila. 7, Pa.

Gentlemen: Please send me

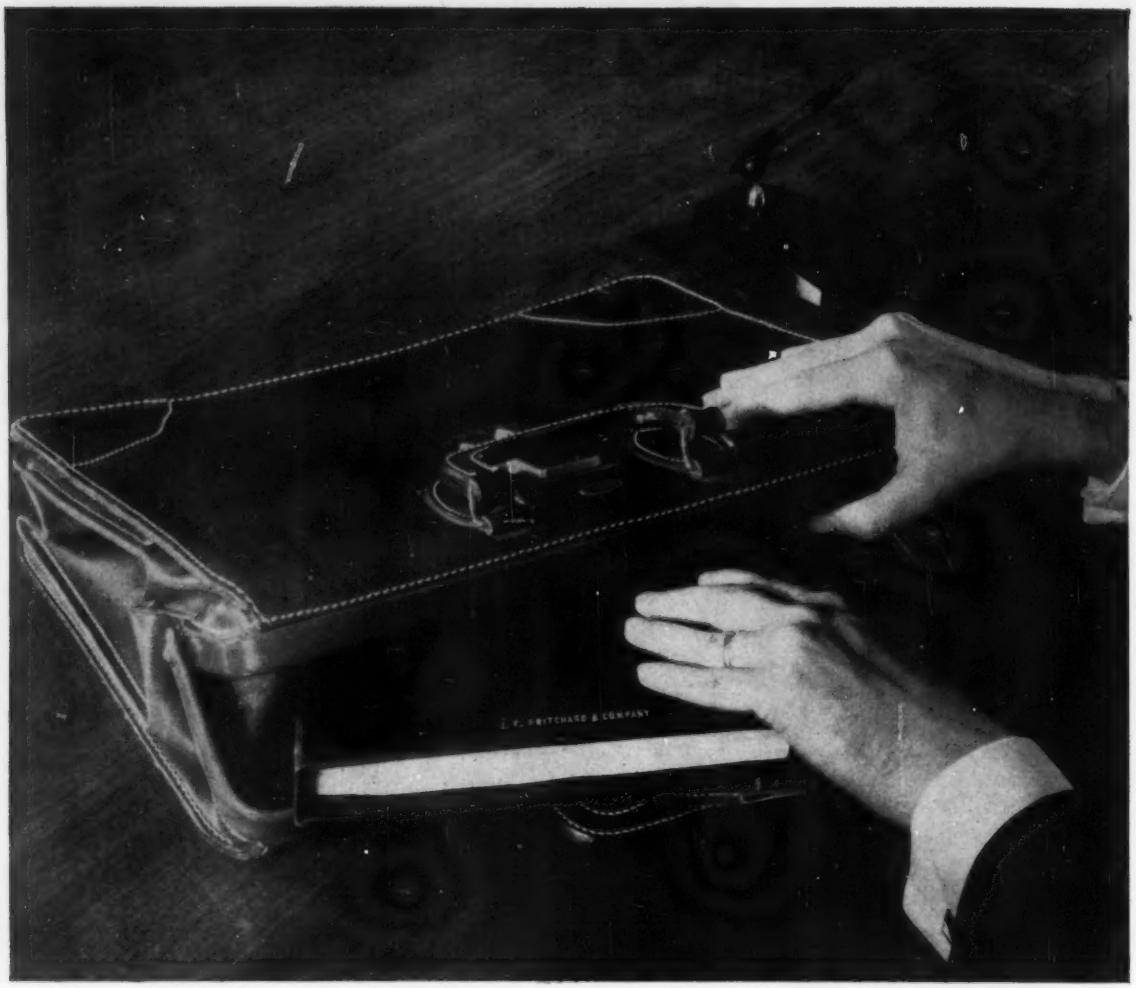
☐ **Bulletin 65-W.**
☐ **Bulletin 22-W.**

NAME
JOB FUNCTION
COMPANY
ADDRESS

JAMES G. BIDDLE CO.

• ELECTRICAL TESTING INSTRUMENTS
• SPEED MEASURING INSTRUMENTS
• LABORATORY & SCIENTIFIC EQUIPMENT

1316 ARCH STREET
PHILADELPHIA 7, PA.



"Contract signed with Pritchard—and with complete confidence"

"I know you've been working with them on plans for the new power plant, but why are you so pleased?"

"Because this is a Pritchard Single Responsibility Contract."

"What kind of a contract is that?"

"It means that Pritchard has taken full responsibility for everything—engineering, design, drafting, purchasing and construction."

"Oh, I see! This way you are dealing with just one company and not a lot of different ones. Is that it?"

"Yes, but just part of it. With this contract, we know what the total cost of the plant is going to be before it's started. Pritchard co-ordinates all of the buying. They save us money on labor. And we get a firm guarantee of operation of the completed power plant. One more very important thing—perhaps the most important . . ."

"What's that?"

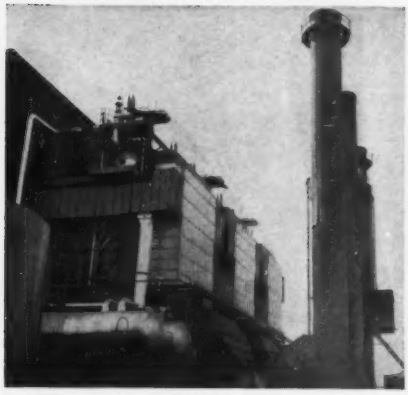
"We start getting a return on our investment faster because the construction job gets done faster."

"I can see now why you feel so good about that contract."

J. F. PRITCHARD & CO.
4625 Roanoke Parkway, Kansas City 12, Mo.

"Contract signed with Pritchard—and with complete confidence."

Three reasons why Pritchard is the choice for power plant design and construction!



Three *big reasons!*

One, Pritchard ability and experience. Unrivaled in the field. Ready to go to work for you now!

Two, Pritchard ability to work *with* your staff on every step from drawing board to completion!

Three, Pritchard's time-saving, money-saving, Single Responsibility Contract!

Three big reasons why—when you plan to build, expand or modernize—it will be wise to include Pritchard in those plans!

YOUR INQUIRY IS INVITED

If you would like more information on Pritchard's Single Responsibility Contract, simply write on your company letterhead. Of course, there is no obligation.

INDUSTRY'S PARTNER FOR PROGRESS

J. F. Pritchard & Co.
ENGINEERS • CONSTRUCTORS
Dept 533 4625 Roanoke Parkway
Kansas City 12, Mo.

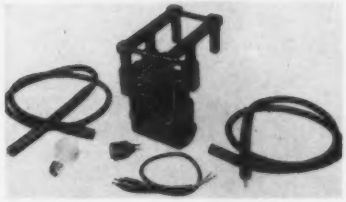
SERVING THE GAS, POWER, PETROLEUM AND CHEMICAL INDUSTRIES
BOSTON, CHICAGO, BUFFALO, HOUSTON, NEW YORK, PITTSBURGH

Transformer Nozzle

A spray nozzle called Model T-1 has been developed for protection of transformers. Manufacturer reports that, with four nozzles per transformer, it is possible to isolate or extinguish a transformer fire before it spreads to other equipment.

The T-1 nozzle delivers about 80 gpm at 25 psi with an 80-deg full-cone spray pattern. Manufacturer says the cast bronze unit has large non-clogging passages and a 2-in. female pipe thread.

Bete Fog Nozzle, Inc, 309 Wells St, Greenfield, Mass.



Phasing Transformer

This phasing transformer is pressure molded in rubber for line-crew safety in phasing out and checking primary voltages. Besides transformer and connectors, the 18-lb complete assembly (1872-B1) includes a rubber-insulated hanger, two plug-in h-v leads, a plug-in lamp socket, and plug-in instrument lead.

The waterproof, dustproof unit operates in temperatures from −65 to 165F. Transformer and h-v leads are of 5-kv insulation class. It is rated at 2,400/4,160Y and has nominal 20:1 ratio.

Elastic Stop Nut Corp of America, A'G'A Division, Elizabeth, N. J.

Luminaires

Three types of luminaires were introduced recently:

• Type XX fluorescent luminaires are available for suspension or surface mounting in offices and stores. The units come in 4-ft lengths and 2 and 4-lamp types.

Equipped with series rapid-start ballasts, the luminaires are shallow units with rounded metal side panels and louver shielding. Rigid steel louvers, hinging down from either side, provide 30-deg crosswise and 25-deg endwise shielding.

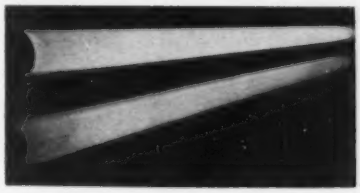
• Type LT fluorescent luminaires are designed specifically for low variable temperature operation. The 6-ft open or closed units are of 1 or 2-lamp design.

Quick-starting lamps can be operated reliably down to −30F. Peak efficiency is at 0F for the enclosed 2-lamp unit and at 50F for the open 2-lamp unit. Also designed for low-temperature operation, ballast is of 2-lamp, 1,000-ma, 110-125-v, series RS type. One ballast serves two single-lamp units.

• General-service ventilated reflectors for indoor industrial use with incandescent lamps are available in either RLM-standard-dome or deep-bowl type and in either Locklite or Bayonet Heel design.

Locklite luminaires have 2-piece detachable construction. The reflector is available for mounting with ½ or ¾-in. stems, 90-deg side entrance conduit, or 4-in. outlet box. Bayonet Heel units, also of 2-piece construction, may be top or side mounted with ½ or ¾-in. conduit or on 4-in. outlet box.

Westinghouse Electric Corp, Lighting Division, Cleveland, Ohio.



Built-in-Reflector Lamp

Seventy percent more downward light is reportedly emitted by a directional fluorescent lamp with an internal reflector, shown above at top. Beneath it is a regular lamp giving off equal light at every angle.

An application of the new lamp is in installations where dust and dirt are present. Manufacturer claims that improvements in lamp lumen-hours are obtained because the lamp is relatively unaffected by deposits of dust and dirt on the top surface of the lamp.

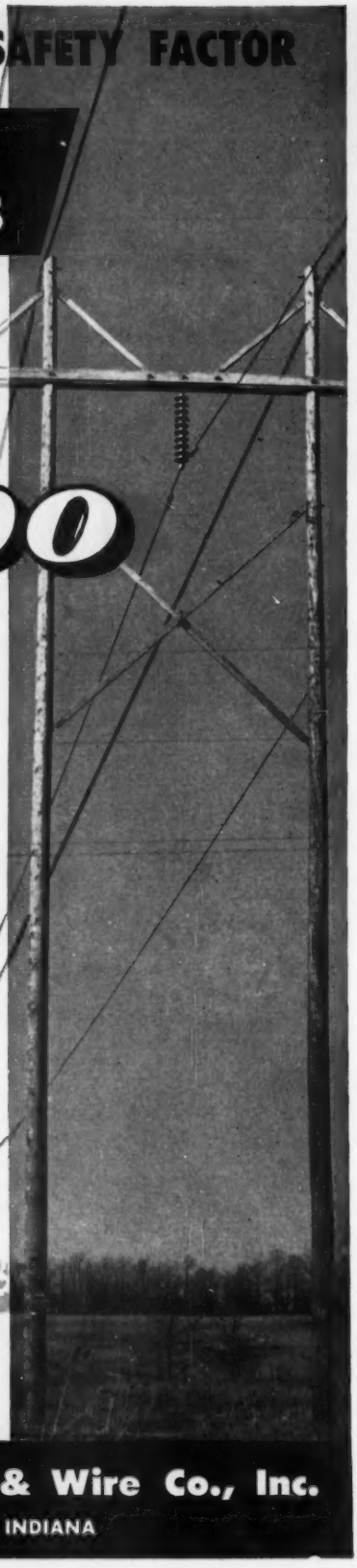
The new lamp may be mounted bare without external reflectors.

Sylvania Electric Products, Inc, 1740 Broadway, New York 19, N.Y.

(More New Products on page 208)

For that EXTRA SAFETY FACTOR

in OVERHEAD GROUND WIRES



Crapo

Weldless Galvanized STEEL STRAND

MAXIMUM STRENGTH and dependability in overhead ground or static wire is assured when you specify *Crapo* Weldless Galvanized Steel Strand, specially designed and manufactured to shield transmission lines against lightning.

CONTINUOUS LENGTHS of this 7-wire strand are produced without welds or joints of any kind in either the individual wires or finished strand. High fatigue endurance provides that extra factor of safety so important in overhead ground wire. Laboratory-controlled manufacturing constantly insures high, uniform quality to make it your most practical and economical strand for this purpose.

Crapo GALVANIZING applies a dense, uniform and ductile zinc coating, tightly bonded to the wires for lasting protection against corrosion. *Crapo* Weldless Galvanized Steel Strand is available with Class A, B or C coatings in approved sizes and grades.

Ask your *Crapo* representative for Booklet OG-25 containing Sags and Tension data . . . or write direct!

INDIANA Steel & Wire Co., Inc.

MUNCIE, INDIANA

MORE NEW PRODUCTS

Gayston Corp, 1225 Ray St, Dayton, Ohio, has a **drum reversing switch** (Model HC) with silver tipped contacts, beryllium copper perloaded contact springs, and molded contact block and barrier. It features self-cleaning, butt-wipe contact action.

General Electric Co, Schenectady 5, N. Y., has a **double-shaft utility motor** for home workshop and farm use. The 21-lb, ¾-hp, 3,450-rpm motor draws full-load current of 10.6 amp at 115 v.

Atkomatic Valve Co, Inc, 545 W. Abbott St, Indianapolis, Ind., has a 2-way, globe-type, pilot-operated **solenoid valve.** The 1-in. stainless steel valve is designed to operate from 10 to 3,000 psi.

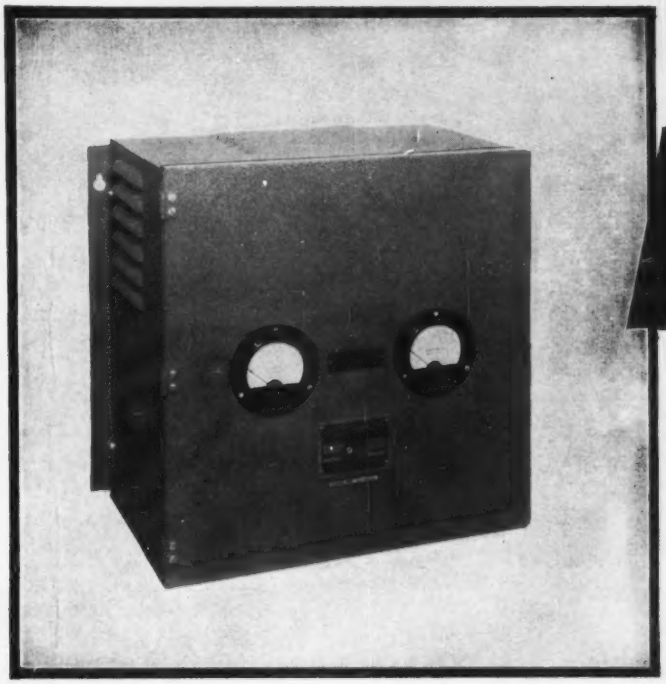
General Dynamics Corp, Electro Dynamic Division, Bayonne, N. J., has rerated NEMA **explosion-proof motor** (Type H) in ratings from 1 to 30 hp. It is designed for areas where inflammable gases, volatile liquids, or combustible dusts are present.

Silicone Insulation, Inc, 567 Third Ave, New York 16, N. Y., has a **silicone glass cloth bobbin** for use in high temperature transformers, solenoids, relays and other coil-type equipment. The bobbin, laminated into a unified structure, is made to customer specifications.

General Precision Laboratory, Inc, Pleasantville, N. Y., has a remote-control, **closed-circuit television** for industrial and utility use. It includes camera, lens iris and focus, indoor and outdoor pan and tilt, and weatherproof housing.

Buffalo Forge Co, Buffalo, N. Y., has a **fan** (Type BLH) for mechanical draft, conduit air conditioning, and industrial applications. The fan, available in wheel diameters from 18¼ to 80¾ in., features cantilevered inlet vanes and streamlined inlet, housing and outlet.

Newage International, Inc, Jenkintown, Pa., has a portable **metal hardness tester** that provides direct readings corresponding to Rockwell A, B or C scales or Brinell medium or low scales.



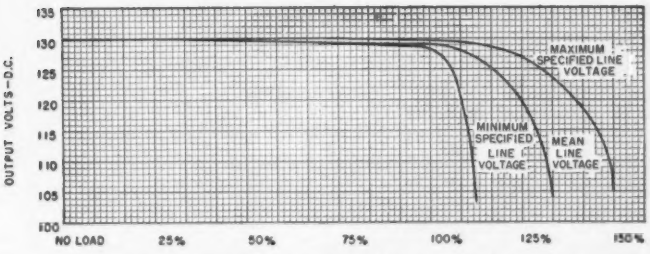
NEW!

Raytheon 60-Cell Battery Charger

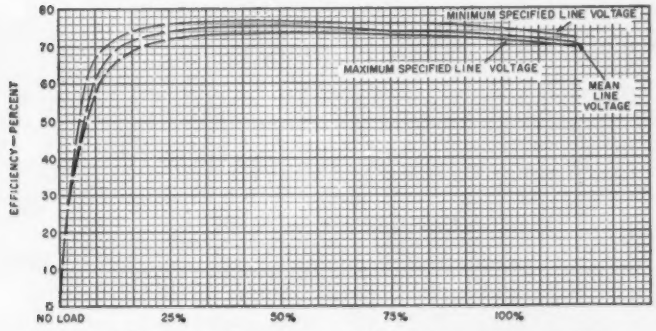
EXTENDS BATTERY LIFE
REDUCES BATTERY MAINTENANCE

IMPORTANT FEATURES

- **Constant potential charging—minimizes battery gassing**
- **Completely static operation—no moving parts**
- **Minimum maintenance—ideal for unattended sub-stations**
- **Rugged magnetic amplifier control circuit**
- **Self-protected—current limiting circuitry**



Regulation Curve (note automatic current limiting at overload to protect equipment)



Efficiency Curve (high efficiency at low loads reduces power consumption)

The new Raytheon 60-cell RectiChargeR® is a constant-potential battery charger specifically designed to maintain utility batteries at full standby potential and to provide maximum battery protection under all conditions. The RectiChargeR lengthens battery life and reduces maintenance, since gassing and water loss due to over or under charging are completely eliminated. Provision for applying periodic "freshening" charges insures uniformly high cell potential at all times.

The 60-cell RectiChargeR utilizes a rugged, magnetic amplifier control circuit which provides regulation to within ±1%. Long life and optimum performance result from completely static operation, self-protecting, current limiting circuitry, and automatic compensation for aging of the conservatively-rated selenium rectifiers.

Available in 3, 6, and 12 ampere models, the 60-cell RectiChargeR is the result of Raytheon's 25 years of experience in the battery charger field. For full information write for Product Data 4-310.

RAYTHEON MANUFACTURING COMPANY

Equipment Marketing Division, Waltham 54, Mass.

RAYTHEON

A 4018

Excellence in Electronics

Announcing General Electric's 1956 RM

Load-Tap-Changing Transformer

- **Maintenance Reduced 50%**
- **20db Switching Noise Reduction**

INCREASED CONTACT LIFE in General Electric's new LRT-68 load-tap-changing switch means routine inspection and maintenance can be cut by 50% on G-E LTC medium transformers.

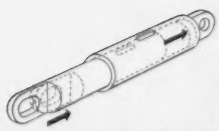
These savings have been made possible by: (1) reducing the amount of contact wear per operation, through redesigning the Geneva gear (providing smoother operation) and adding hydraulic dashpots (for optimum separation and engagement speeds) and (2) using heavier, thicker contact tips, from which more material can wear before replacement is necessary.

QUIETER OPERATION results from redesign of G.E.'s load tap changer. New Geneva gear is quieter, and mounting of motor and drive assembly under oil in switch compartment muffles noise. These features provide increased customer goodwill and less investment in sound-reducing barriers in residential areas.

RM (Repetitive Manufacture) brings you these savings in the entire line of LTC medium transformers. Also, RM transformers can be delivered to you faster . . . important in case of emergencies. For complete information, contact your G-E Apparatus Sales office, or write to Section 416-5, General Electric Company, Schenectady 5, N. Y.

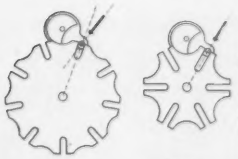
Progress Is Our Most Important Product

GENERAL ELECTRIC

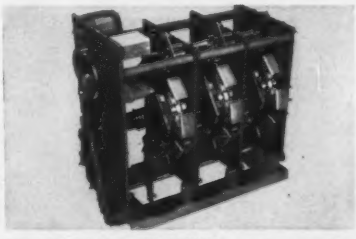


NEW HYDRAULIC DASHPOTS provide optimum separation and engagement speeds to minimize erosion and secondary arcing—increasing tip life.

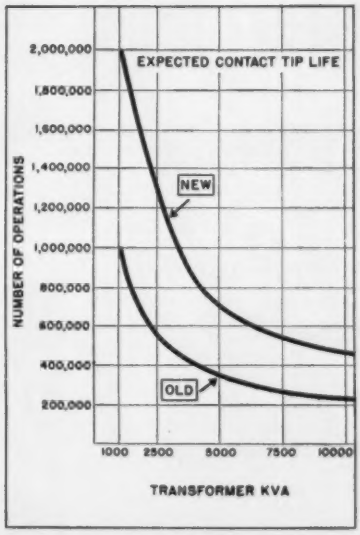
NEW FEATURES of LRT-68 switch are hydraulic dashpots and redesigned, quiet-acting Geneva gear shown in detail at left.



NEW GENEVA GEAR driving pin enters smoothly instead of 19° angle. This reduces jarring and impact, cuts noise, extends contact life.



NEW LOAD TAP CHANGER now incorporates motor and drive assembly. Oil immersion muffles noise, provides permanent lubrication.



NEW MAINTENANCE RECOMMENDATIONS are based on increasing the expected tip life, up to 2,000,000 operations for a 1000-KVA transformer.

To See More of the Advantages of G-E's New RM Transformer for '56

TURN PAGE ⟶

All the features you asked for make

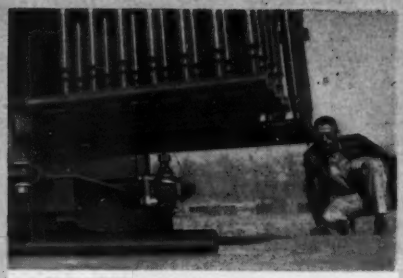
1956 Load-Tap-Changing RM* Medium Transformers

Your Best Buy

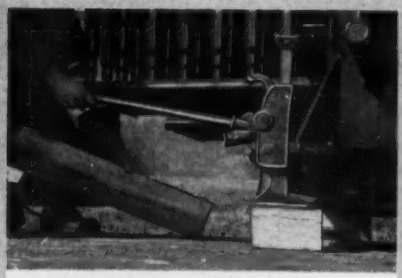
*Repetitive Manufacture

Progress Is Our Most Important Product

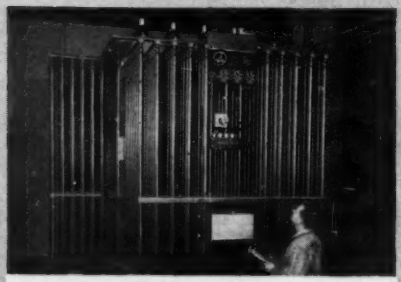
GENERAL ELECTRIC



SLED-RUNNER BASE on all G-E RM transformers slides easily or rides smoothly over rollers, simplifies installation. Wide face on I-beam won't cut rollers.

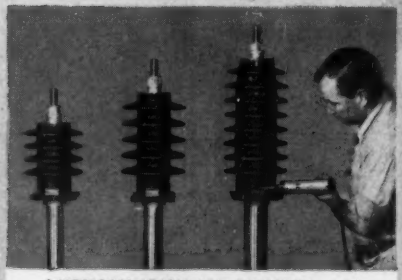


LIBERAL JACKING SPACE cuts installation time and effort. Minimum of 5½ inches from ground to jackpad suitable for most jacks.

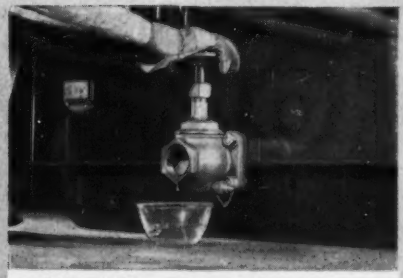


CONTROL CENTER groups all instruments and nameplate; improves visibility, makes readings extra simple.

PROTECTED ACCESSORIES. Recessed behind cooling tubes; sheltered against damage during shipping and installation.



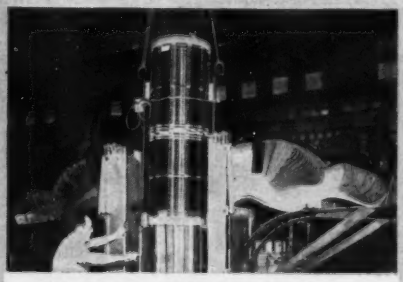
AMERICAN STANDARD BUSHINGS, used on all General Electric RM Power Transformers, help reduce bushing inventories.



FULL DRAIN permits complete filtration, removes worst bottom oil. Sampling is more accurate.

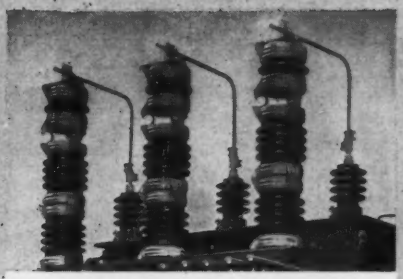
FORMEX* insulation is extremely rugged, has phenomenally high dielectric strength. Permits smaller, lighter units.

*Reg. Trade-mark G. E. Co.

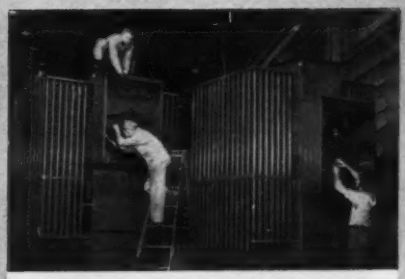


PRE-FORMED CORE gives reduced losses since flux path follows grain in core laminations.

VENTILATED BASE permits free air circulation, protects against condensation, adds years between repaintings.

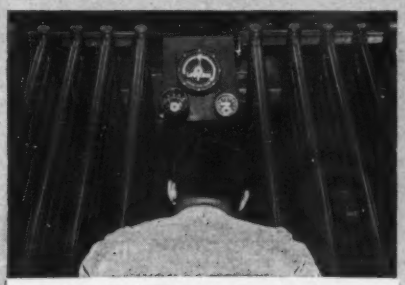


PRE-FITTED CONNECTORS between arrester and bushing simplify field installation, give better lightning protection.

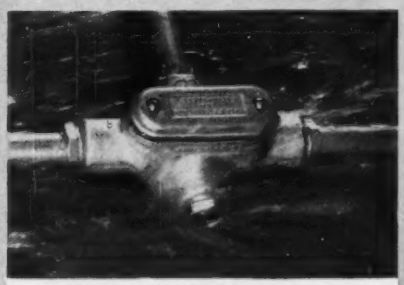


REVERSIBLE JUNCTION BOX readily adapts to overhead or underground system, simplifies ordering and interchangeability.

ONE CONTROL CONDUIT simplifies control wiring. Connections are made to one terminal board for entire transformer.



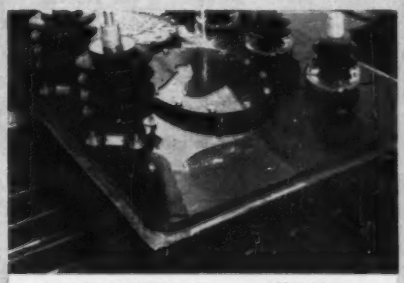
TILTED INDICATORS, where height requires, make instrument reading easier, more accurate.



CONDUITS AND FITTINGS are weathertight, can be assembled in minutes without cutting threads.

NITRILE GASKETS resist weathering, seal without adhesives. Reusable again and again, they reduce gasket inventories.

SUPER MELAGLYP FINISH saves up to two repaintings, is longer lasting in corrosive atmospheres.



DOMED COVERS let water run off, help prevent dirt and rust accumulations. Flanged openings prevent foreign matter, moisture from rolling into tank.

SPRAY-ON PAINT, provided with every RM transformer, permits touching up after installation, before rust gets foothold.

WEDGE-TYPE TAP CHANGERS have self-aligning, rugged contacts; can carry full short-circuit current.

LARGER MANHOLES mean easier accessibility to interior; allow better and easier inspections.

GENERAL ELECTRIC

Jersey Central Power & Light Co., South Amboy, N. J. Burns & Roe, Engineers.
The Cope Cable Trough shown above carries as much cable as all of adjacent system.

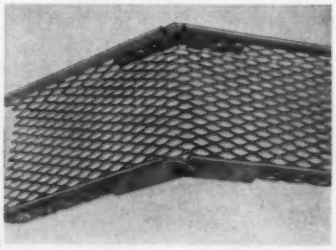
Jersey Central Power & Light Company Cuts Costs with Cable Trough

The great space saving possible with Cope Trough is dramatically illustrated at Jersey Central Power & Light Company's South Amboy installation of cable supports. Where space is at a premium, specify Cope Cable Trough.

SAVE LABOR during installation. Cope Cable Trough with the exclusive Pin-Type Coupler goes in faster than any other trough system. Standard fittings are available for virtually any connection, corner, awkward space—yet fewer individual pieces are needed and installation time is greatly reduced.

SAVE MATERIALS with Cope Cable Trough. You support far more cable with the same weight of Trough than with any competing system—and steel is costly.

Elevation changes are simple with Cope Trough. Edges of the Trough may be cut readily and standard fittings insure rigid support.



Our engineers are ready to work with you. Write us today for full details on new 70,000 Series.

T. J. COPE, INC.

711 SOUTH FIFTIETH STREET, PHILADELPHIA 43, PENNA.

Cope

GROUND TENTS

ROD GRAPPLES

CABLE REEL JACKS

WARNING SIGNS

CROSS ARM SHEAVES

CATALOGS—BULLETINS

● **SOLID-FILM LUBRICANT:** Description and applications of a solid-film lubricant are given in 8-page Brochure No. B-3. Electrofilm, Inc, P. O. Box 106, North Hollywood, Calif.

● **BRAZING ALUMINUM:** A 134-page book titled "Brazing Alcoa Aluminum" describes brazing materials and processes. Photographs illustrate methods, and tables fully cover methods and materials. Aluminum Co of America, 774 Alcoa Bldg, Pittsburgh 19, Pa.

● **EXCAVATOR:** Self-propelled power crane and excavator is described in 4-page Bulletin No. CR-501. Specifications, features, operating data, and capacities of the 6-ton model are given. Schield Bantam Co, Waverly, Iowa.

● **POLE PRESERVATIVE:** Three types of above-ground and ground-line treatment for standing poles using pentachlorophenol preservative compounds are described in an illustrated bulletin. The treatments, which can be used independently or together, are suited to field use. Chapman Chemical Co, P. O. Box 138, Memphis 1, Tenn.

● **CABLES:** Line of solid-type, lead-sheathed, paper-insulated cables for voltages up to 33 kv is subject of 104-page Publication No. 358. The book covers specifications, finishes, voltage tests, current ratings, installation, general requirements, accessories, and cable and conductor data. British Insulated Callender's Cables, Ltd, 21 Bloomsbury St, London, WC1, England.

● **EARTH BORER:** Line sketches, close-up views of construction photos, and descriptive material on a portable hydraulic earth borer (4401-H) are given in a 4-page catalog. The unit bores 8 to 20-in. holes up to 8 ft deep. J. H. Holan Corp, 4105 W. 150th St, Cleveland 11, Ohio.

● **TESTING INSTRUMENTS:** Electrical testing instruments for many utility and industrial uses are covered in 16-page Bulletin 19-56 which lists individual bulletins for every product in the line. Cable fault locating equipment and corona test equipment are included. James G. Biddle Co, 1316 Arch St, Philadelphia 7, Pa.

● **LIGHTING:** Lucite acrylic resin and the applications which are being found for it in the lighting field are covered in 12-page brochure. Complete list of properties is included. E. I. duPont de Nemours & Co, Polychemicals Department, Wilmington 98, Del.

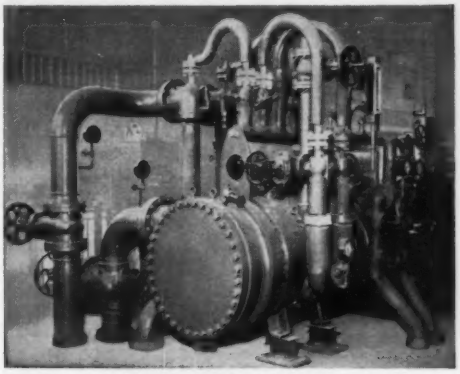
● **CURRENT TRANSFORMER:** Bulletin No. GED-2727 describes a 15-kv outdoor current transformer molded of Hy-Bute/60 insulation. The 8-page brochure contains information on application, construction, accuracy, ratings, and ratio and phase-angle test data. General Electric Co, Schenectady 5, N. Y.

● **FIBERGLAS INSULATION:** "Materials for Industry" (12 pages) covers Fiberglas and Kaylo insulation products for electrical applications. Owens-Corning Fiberglas Corp, Toledo 1, Ohio.

(*More catalogs on page* 216)

"SELF-CLEANING" C. H. WHEELER PATENTED REVERSE FLOW STEAM CONDENSERS OPERATE ROUND-THE-CLOCK

THIS C. H. WHEELER PATENTED REVERSE FLOW SURFACE CONDENSER is a two pass, divided water box, dual bank design capable of condensing 440,000 lbs. per hour of exhaust steam. Condensing surface is 55,000 square feet.



C. H. WHEELER TUBEJET AIR PUMP consists of two 2-stage elements, mounted on surface type inter-after-condenser. Each 2-stage element is designed to handle 97.5 lbs. per hour air vapor mixture at 1 inch HG absolute.

C. H. WHEELER CIRCULATING PUMPS are 30" x 42" Vertical Mixed Flow, pull-out type. Capacity is 30,000 GPM each at a total head of 36.2 feet. Pumps are driven by 400 HP, 600 RPM synchronous speed vertical induction type motors.

New Deaerating Features Reduce Oxygen Content to Less Than 0.01 cc Per Liter

Progressive power companies are eliminating condenser shut downs and operation at reduced loads by installing C. H. Wheeler Patented Reverse Flow Steam Condensers.

One rapidly expanding utility has just put their fourth C. H. Wheeler Reverse Flow Condenser on the line. The latest unit, shown above, is not only "Self-Cleaning" but also has special new deaerating features that reduce the oxygen content of the condensate to less than 0.01 cc per liter. Continuous measurement by accurate recording instruments has proved that this low oxygen content is consistent over a wide range of load and temperature conditions.

Condenser circulating water used by this power company comes from a brackish river, laden with debris and leaves which clog steam condensers of regular design. "Self-Cleaning" C. H. Wheeler Patented Reverse Flow Condensers have solved their problem of how to avoid the expensive shut downs required to hand clean clogged tubes and tube sheets.

Debris is flushed away from the tubes and tube sheets simply by reversing the flow of cooling water through the condenser by means of hydraulically controlled built-in valves. Cleaning takes only a matter of minutes and can be accomplished under full load operating conditions with only a slight vacuum reduction. The power plant therefore can operate at full capacity round-the-clock.

Whatever your problems are . . . down time, deaeration, special operating conditions or requirements . . . let C. H. Wheeler help you solve them. Our engineering skill and experience can pay you high dividends in economy and efficiency.

Phone or write your local representative or our Philadelphia office for literature, information, or assistance.

WES07

C. H. Wheeler OF PHILADELPHIA

C. H. WHEELER MANUFACTURING CO., 19TH & LEHIGH, PHILA. 32, PENNA.

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for insulated wire, one source **Continental**

For the run-of-the-mill wiring problems—or the hundreds of specials—the one source for practically all types of permanently insulated wire—is Continental. Whether it's electronic hook-up wire, military hook-up wire or cable, switchboard AVB—TA—SHFS Cable or Wire . . . Asbestos, Glass, Nylon, Varnished Cambric, Polyethylene, etc. . . . the **Always Correct Source** is Continental Wire Corporation. Refer your special wiring problems today to Continental's Wire and Cable specialists.

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SWITCHBOARD and RHEOSTAT WIRE—TYPE AIA
600 VOLT SERVICE
Available Sizes: 18 to 4/0 AWG inclusive

Solid copper conductor, asbestos insulation, asbestos braid . . . heat, flame and moisture resistant. U.L. Approved. Ideal for wiring rheostats, switchboards, control panels, and ovens where oil, grease, corrosive vapors, moisture **and high temperatures** are present. Maximum operating temperature 257°F.

Continental
WIRE CORPORATION
WALLINGFORD, CONNECTICUT • YORK, PENNSYLVANIA

CATALOGS—BULLETINS

(*Continued from page* 212)

• **ELECTRICAL PRODUCTS:** Engineering and manufacturing facilities at the company's Sunnyvale, Calif., plant are described in Bulletin No. B-6549. The 31-page booklet also describes electrical and associated products manufactured at the plant .This ranges from small motors, generators and heating equipment to large steam turbines, switchgear and transformers. Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.

• **PIPING INSULATION:** "Thermobestos Pipe and Block Insulation" gives information on a hydrous calcium silicate insulation for hot outdoor piping and process equipment operating up to 1200F. Complete heat transmission tables are included in the 12-page booklet. Johns-Manville, 22 E. 40th St, New York 16, N. Y.

• **COOLING TOWERS:** Construction and operational details of an induced draft cooling tower are described in Bulletin No. CT-56-1. The 4-page booklet dipicts major equipment features. Foster Wheeler Corp, 165 Broadway, New York 6, N. Y.

• **MOTOR CONTROL CENTER:** Compactly designed general purpose motor control center is described in 24-page Bulletin No. GEA-6367. It contains details on construction and application. Ratings, weights, dimensions, installation data, and guide form specifications are included. The control center (Type DA7093) is designed to accommodate starter units of either fusible or circuit-breaker type in NEMA sizes 1 through 5. General Electric Co, Plainville, Conn.

• **PACKAGE SUBSTATIONS:** Standardized and package substations for light-load areas are described in Bulletin No. 11B-7895A. It lists material furnished for h-v and l-v structures, and it diagrams optional arrangements for each. Nearly any requirements of capacities and voltages can be met. Allis-Chalmers Mfg Co, 932 S. 70th St, Milwaukee, Wis.

• **MECHANICAL TUBING:** Bulletin No. TB-362 tells how, in a number of case histories, a line of electric-resistance-welded carbon steel mechanical tubing solved engineering problems and simplified production and cut costs. Babcock & Wilcox Co, Tubular Products Division, Beaver Falls, Pa.

• **OIL FUSE CUTOUTS:** Detailed information and dimensions of unit cutouts and cutout boxes are contained in Bulletin No. CB56. The 14-page booklet gives data on the new FL fuse link. G&W Electric Specialty Co, 7780 Dante Ave, Chicago 19, Ill.

• **ANTI-CORROSIVE PAINTS:** Line of metal protective paints for electric utility requirements is covered in 8-page catalog. Full descriptions and applications are given. Subox, Inc, Hackensack, N. J.

• **HYDRAULIC LADDER:** Operating and design features of manually operated hydraulic ladder are included in Series 2500 ladder catalog. J. H. Helan Corp, 4105 W. 150th St, Cleveland 11, Ohio.

• **SPLICING KITS:** Bulletin No. JA56 gives general data on material in unit packages for joints, 2-way and 3-way, on practically all kinds and sizes of solid type cables. G&W Electric Specialty Co, 7780 Dante Ave, Chicago 19, Ill.

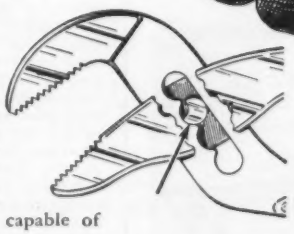
SOMETHING NEW!

30% THINNER
TWICE AS STRONG
GRIPS LIKE A PIPE WRENCH

CLEAN, SHARP TEETH
FLUSH RIVET NO PROJECTIONS
BOX JOINT ADJUSTABLE TO 4 POSITIONS UP TO 1½" CAPACITY
EXTRA THIN—ONLY ½" AT THICKEST POINT
NON-SLIP CHECKERNUT KNURLING
CRESCENT TOOL CO. JAMESTOWN, N.Y.
P-210
PATENT PEN

Crescent's No. P210 Utility Plier is completely new ... revolutionary! It's not a "slip-joint" plier and not to be confused with conventional lap-joint "pump" pliers. Its *double-strong* box joint design is absolutely unique and assures a powerful grip like that of a pipe wrench without sideways twist or strain. It will grip flat, square, hex or round objects with powerful leverage.

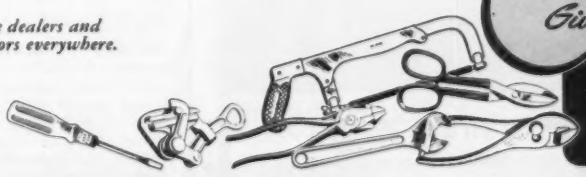
QUICK, POSITIVE ADJUSTMENT



This cut-away view shows joint construction with its extra generous bearing surface at the arrow point. Adjustment is made by simply "walking" the rivet recess over the bearing point with a pumping action of the handles. Easy, positive, capable of heavy loads.

Handsomely finished in rust-resistant zinc plate. Overall length 9½ inches.

Sold by hardware dealers and industrial distributors everywhere.



CRESCENT TOOLS
Give Wings to Work
®
Sign of the Artisan Symbol of Excellence

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

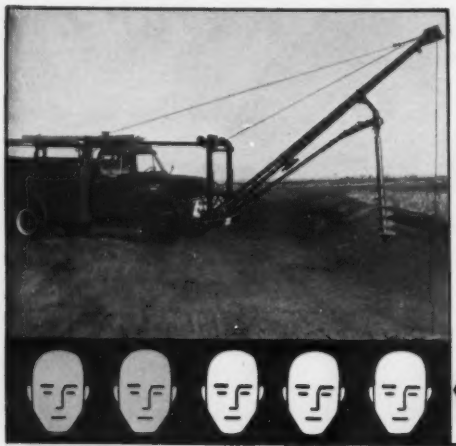
CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

Convert Payrolls to Profits

Tel-E-Lect's complete line of front operated equipment now enables utility companies to do twice the amount of work with smaller crews in just half the time. If you're still using 5-man crews on obsolete utility equipment (even on a new chassis), you have extra men on the payroll that can be making a profit for you on another job. Tel-E-Lect builds the services of three men into its utility truck equipment. Now, *two men* can do the work once done by five!

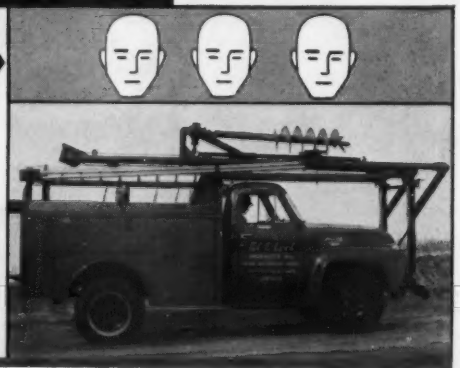
Adaptable to all makes of popular trucks, Tel-E-Lect quality-built front operated equipment is fast and versatile. The simplicity of operation of its winches, digger drive kits, FLD units, derricks, diggers and augers make them efficient and economical—require smaller crews to operate, thus freeing men for other jobs and for big, highline work.

After just *two minutes* on location, the digger and derrick are ready to go to work. Digger and derrick equipment are brought into working position by simply engaging winch line. The digger remains attached to the derrick and is raised or lowered by actuating a single lever in the cab. The load line is now available for pole setting. When digging in hard soil or frozen ground, the weight of the pole may be used as ballast for additional auger pressure.



Tel-E-Lect equipment saves three men out of five for other work.

These men are now available for other important jobs!



Compact, custom-built bodies and utility equipment by Tel-E-Lect are capable of handling the major portion of Telephone and Power Co. work. This unit is shown with derrick and digger stowed overhead for travel.

Write for literature on Front Operated Equipment

TEL-E-LECT PRODUCTS, INC.
10003 Minnetonka Blvd.
Minneapolis 26, Minnesota

TECHNICAL LITERATURE

ELECTRICAL EQUIPMENT—"Technical Notes on Electrical Equipment" is a 52-page basic study and reference manual. It contains easy-to-read, practical information on incandescent, mercury vapor, and fluorescent lamps and accessories, lighting fixtures, air conditioners, electric space and industrial heaters, ac and dc motors and generators, transformers, motor controls, rectifiers, converters, switches, and protective devices. Each product is covered by simplified drawings, diagrams and text covering details of construction, operation and application. Electrical Wholesaling, 330 W. 42 St, New York 36, N. Y. Price $1.00.

EEI SPECIFICATIONS — Specifications for Solder-Sweated Split Tinned Copper Connectors, TD-160 1955, are one of a series issued by the Transmission and Distribution Committee of Edison Electric Institute covering various materials used in line construction. The specifications "cover solder-sweated split tinned copper connectors commonly used in underground construction for round concentric, round compact, sector and sector compact stranded cable and AWG sizes 4 and 6 solid wire." Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y.

NUCLEAR METALLURGY — A 96-page book gives the latest information on the behavior of metallic materials in the corrosive conditions encountered in nuclear reactors. Included are six articles by authors presenting technical papers at a Symposium on Nuclear Metallurgy conducted by Institute of Metals Division of AIME during the annual meeting, February, 1956. American Institute of Mining and Metallurgical Engineers, Inc, 29 W. 39th St, New York 18, N. Y. Price $2.50 to members.

RADIATION CONTROL—Bulletin CA-12 (3 pages) tells how to determine the proper control system for direct radiation. The data sheet, illustrated with charts and graphs, covers control of steam and hot water and discusses both two-position and proportioning modes of control. Barber-Colman Co, Dept 766, Rockford, Ill.

STANDARDIZATION — Government-industry cooperation in standardization is subject of a transcript of the Sixth National Conference on Standards, held last October at Washington, D. C. The 94-page book contains all addresses made during the conference. The 30 speeches, made by government, industry and military leaders, point out the effectiveness of standards in saving money and increasing efficiency. American Standards Association, 70 E. 45 St, New York 17, N. Y. Price $3.00.

INCINERATOR DESIGN—Bulletin S contains a compilation of data adopted by members of Incinerator Institute of America as the best standard design practices in the industry today. Incinerator Institute of America, 420 Lexington Ave, New York 17, N. Y.

TECHNICAL BIBLIOGRAPHY —"Publications from Illinois Institute of Technology" contains references to theses completed by the graduate students. Also, it lists scientific and scholarly works published by the university staff including the college, graduate school, and Armour Research Foundation. Illinois Institute of Technology, Technology Center, Chicago 16, Ill.

Underneath this turbo generator is the fuel and the heat for an instantaneous and costly conflagration

...give your equipment the best fire protection—

A BLAW-KNOX AUTOMATIC FOG SYSTEM

Engineered to give your generators and other equipment positive protection against fires, a BLAW-KNOX *Automatic* FOG SYSTEM goes into action immediately:

- *smothers flames*
- *dissipates heat*
- *protects adjacent equipment*
- *prevents loss of revenue*
- *prevents service stoppage*
- *avoids customer complaints*

Why not give your equipment the BEST possible protection? Let a Blaw-Knox *fire-protection* Engineer study your needs. He will gladly submit a layout and a cost estimate . . . with no obligation to you.

"Little Joey Sprinkler" always on the job

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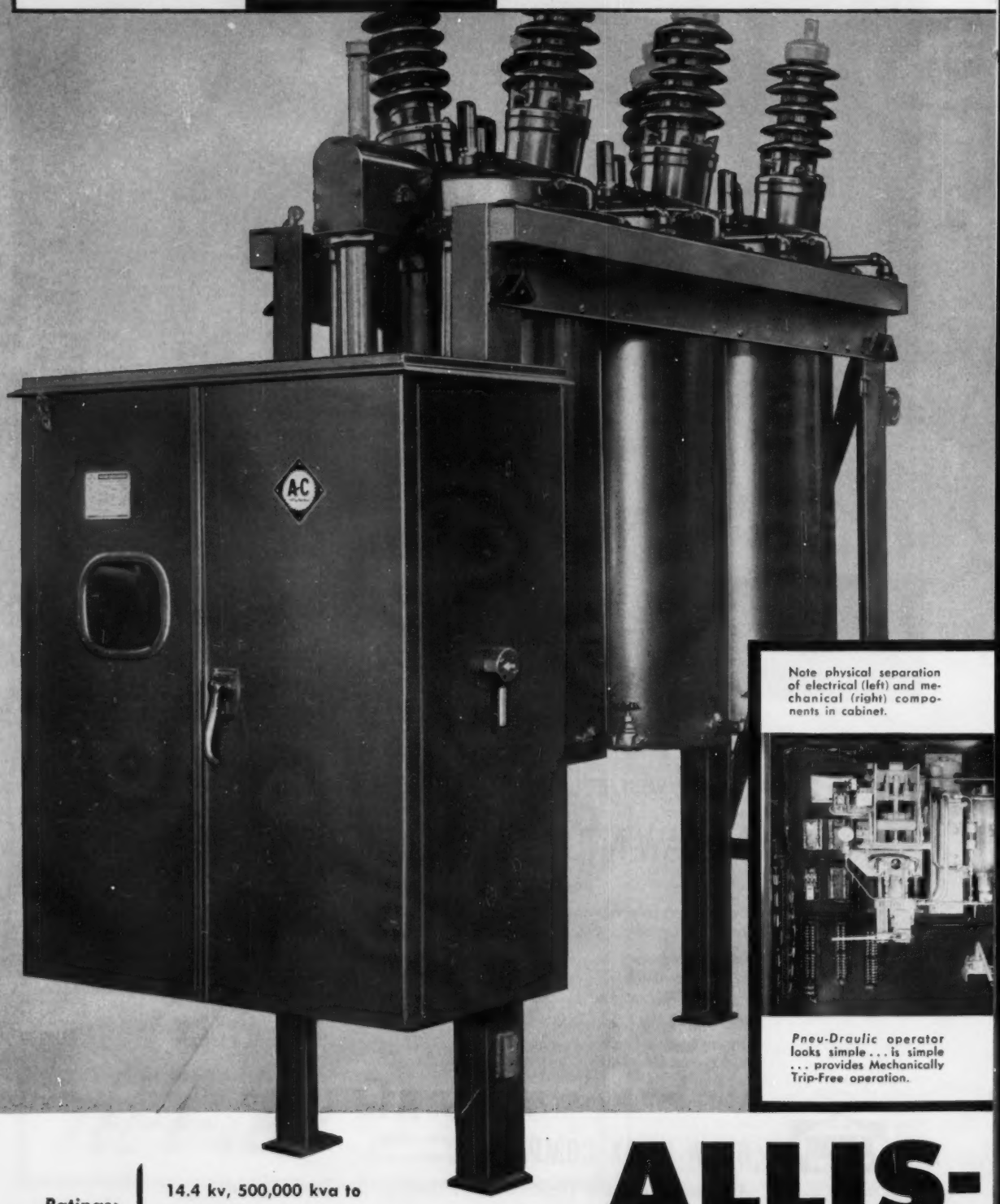
A BLAW-KNOX Automatic FIRE PROTECTION SYSTEM for EVERY NEED

BLAW-KNOX COMPANY

Automatic Sprinkler Department • Pittsburgh 33, Pennsylvania

You get MORE when it's Built by



Note physical separation of electrical (left) and mechanical (right) components in cabinet.

Pneu-Draulic operator looks simple . . . is simple . . . provides Mechanically Trip-Free operation.

Ratings: 14.4 kv, 500,000 kva to 69 kv, 3,500,000 kva

ALLIS-

ALLIS-CHALMERS

NEW

frame-type Allis-Chalmers

BREAKER

Completely Redesigned from Top to Bottom for MORE Accessibility

Here are some of the many features of this new breaker:

- Low maintenance, due to:
  a) Simplified external adjustment of overtravel stop . . . no feeler gauges required.
  b) Single lift rod guide (in place of two) for greater accessibility to pole unit mechanism.
  c) Only four bolts hold tank to frame . . . simplifies lowering.
  d) Cabinet built shallow for easy access.
- No tank liner required.
- High efficiency oil-gas separator.
- AEIC standard wiring *plus* ASA standardized bushings.
- 100% Mechanically Trip-Free — like all Allis-Chalmers breakers.
- Available with *Pneu-Draulic*, pneumatic or solenoid operator.

For the rest of the story, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

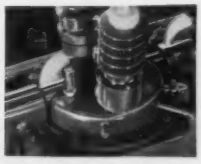
A-5011

Ball-type position indicator on top of breaker visible from 360 degrees.

Side trip provides accessibility — *plus* provision for padlocking.

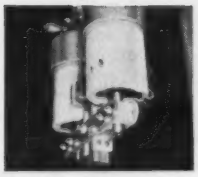
Sampling oil is drawn from the working area of breaker tank.

Smooth fabricated steel top for each tank — free from crevices or ridges.

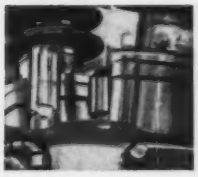


Operator cabinet is low to foundation level for easy access to interior.

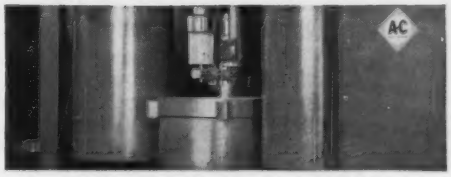
CT lead ducts eliminate conduit—have removable bottom plates for full-length access.



Turbo Ruptor device has threaded pot for easy removal . . . self-aligning tulip and bayonet contacts.



Float-type oil gauge provides more visibility . . . eliminates leakage of sight type gauge.



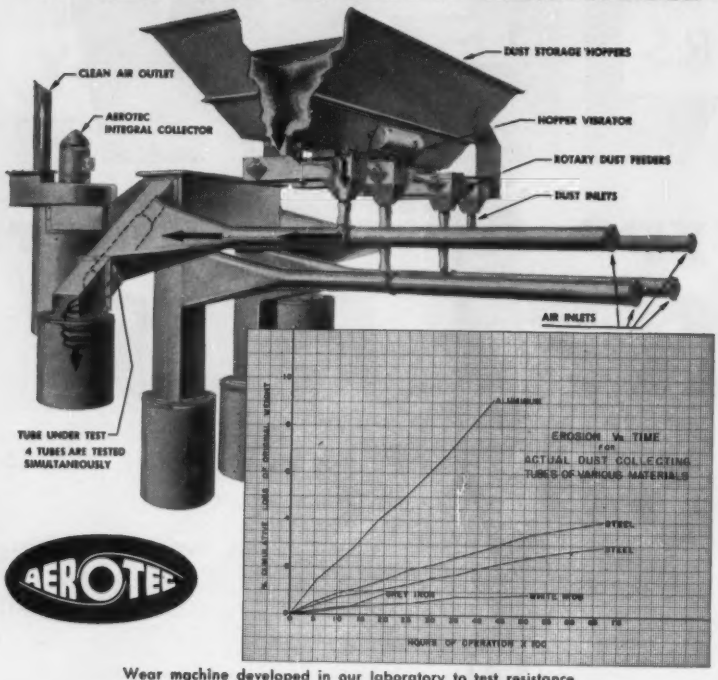
Access to tanks and contacts is unobstructed by frame. Note full tank skirt for stability when lowered.

Pneu-Draulic and *Turbo Ruptor* are Allis-Chalmers trademarks.

CHALMERS

A-C ALLIS-CHALMERS

...PROVING EROSION RESISTANCE



Wear machine developed in our laboratory to test resistance of various metal tubes. Above chart shows loss of weight in tubes of aluminum, steel, grey iron and white iron.

years of research by AEROTEC now assure *longer tube life* for mechanical dust collectors

Dust collector tubes of aluminum, because of the ductility of the metal, were at one time thought to be more erosion resistant than steel. However, *accelerated tests now prove conclusively that of all the basic metals tested, white cast iron tubes assure greatest resistance to abrasion.*

In setting up the test procedure, unusually severe abrasive conditions were simulated—many times more severe than ever encountered in field installations. The most troublesome dust erosion-wise was selected for the test. After 6700 hours of continuous operation, tube wear for various metals produced the curves shown on this page. Note the outstanding performance of the white iron tube. Although in many cases aluminum tubes are proving entirely satisfactory, white iron is now recommended for the majority of new installations.

In development for over three years, the new Aerotec 5" white iron tube will assure longer life and continuing high efficiency in your dust collection equipment. Why not call or write today for complete information? Address The Thermix Corporation, Project Engineers for Aerotec.

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.
(Offices in 38 principal cities)

Canadian Affiliates: T. C. CHOWN, LTD., 1440 S. Catherine St. W., Montreal, Que.

Manufacturers
THE AEROTEC CORPORATION
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Designers and Manufacturers of Automatic Controls, Valves — Regulating, Relief, and Check Type; Pressure Switches; Gauge, Altitude, Differential and Absolute Types — Float Switches: Top, bottom or side mounted — Single, Dual or Tandem.

BOOKS

Books Received Since March 5, 1956

Electrical Circuits. By Charles S. Siskind. Published by McGraw-Hill Book Co. 330 West 42nd St, New York 36, N. Y. 516 pages, illustrated. Price $6.75.

Mains Practice. By T. H. Carr. Published by George Newnes Ltd, Tower House, Southampton St., Strand, W. C2, England, 352 pages, illustrated. Price 35/net.

Factory Electrification. By F. T. Bartho and C. H. Pike. Published by MacDonald & Co. Ltd., 16 Maddox St. London, W. 1, England. 398 pages, illustrated. Price 35/-net.

Electric Generation Steam Stations. By Bernhardt G. A. Skrotzki. Published by McGraw-Hill Book Co, 330 W. 42nd St., New York, 36, N. Y. 454 pages, illustrated. Price $8.50.

Architects View Electric Heat

Architectural Engineering. By editors of Architectural Record. Published by Dodge Books, 119 W. 40th St., New York 18, N. Y. 500 pages, illustrated. Price $11.50.

New concepts, methods and applications in building construction are covered in this book, a compilation of articles which previously have appeared in Architectural Record. The heat pump is given special treatment with stories on installations in two southern office buildings and an analysis of tests made in five homes by American G&E Service Corp. It also contains reprints significant articles on solar heating, commercial lighting, air conditioning, and electrical systems design. This book should be of special interest to commercial and residential sales engineers, for utilities as well as manufacturers.

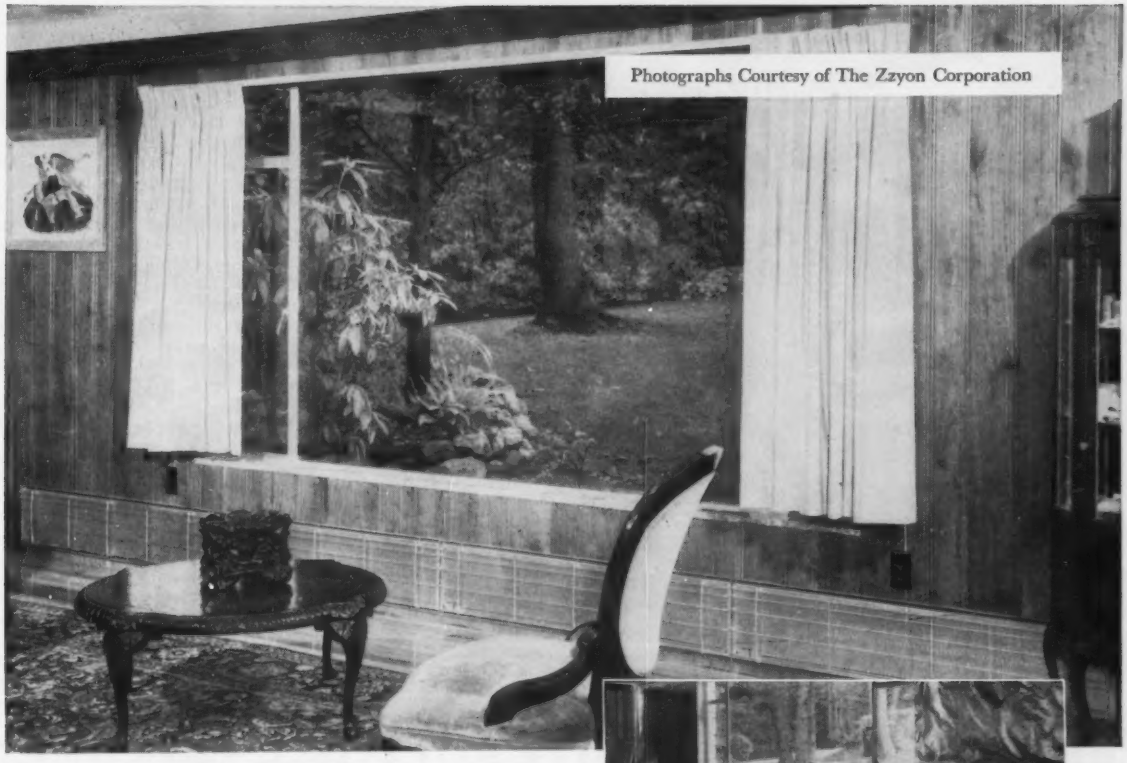
How to Harness Sound

Sonics. By Theodor F. Hueter and Richard H. Bolt. Published by John Wiley & Sons, Inc, 440 4th Ave., New York 16, N. Y. 465 pages, illustrated. Price $10.00.

Sonics in this book includes the frequency range from audible sound to the ultrasonic. Principles are presented in general form, then expanded into the two major applications—sonic processing and analysis. Chapters are devoted to tranducers for sound generation and reception. An appendix discusses propagation in fluids.

Underlying physics is presented in simple form, followed by simplified engineering formulae and instructions for their use. Numerous tables and design curves provide data for convenient use. The aim has been to make the book understandable to any graduate engineer or scientist with

(*Continued on page* 224)



Photographs Courtesy of The Zzyon Corporation

Proper insulation insures an economical, efficient heating system.

RADIANT GLASS HEAT

getting hotter every day

Demand for clean, safe and convenient heat explains the leaping growth of glass panel heating.

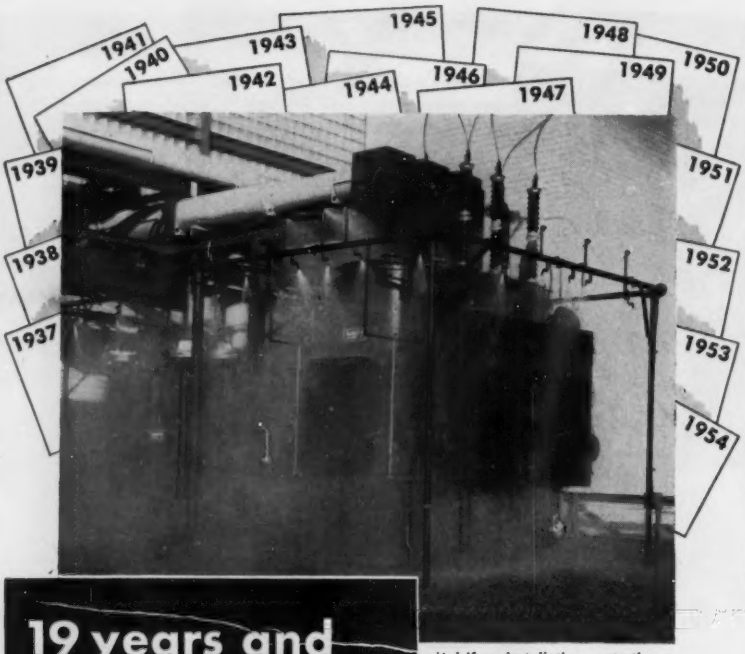
Ra-Grid* Heater Plates by Blue Ridge make possible one of the most adaptable heating systems . . . a big advantage in remodeling and expanding. Heating units can be installed in walls, baseboards or ceilings, or used as portable units. Regardless of where they're used, Ra-Grid Plates reach full operating temperatures in a shorter time than other heater plates. They maintain an even temperature throughout a room . . . free from drafts and cold spots.

You can recommend and use Ra-Grid Heater Plates with confidence. The glass is tempered for resistance to thermal shock and impact. For over 10 years, Blue Ridge has made Ra-Grid Heater Plates for manufacturers who fabricate them into complete heating units. Look for "Ra-Grid" imprinted near the edge of each glass panel.

This business is getting h-o-t! Write for further information and the names of radiant heat manufacturers who use Ra-Grid Heater Plates. *®

MADE BY **BLUE RIDGE GLASS CORP.**
KINGSPORT, TENNESSEE

BLUE RIDGE GLASS CORP.



19 years and 28 installations ago...
at Philadelphia Electric Company

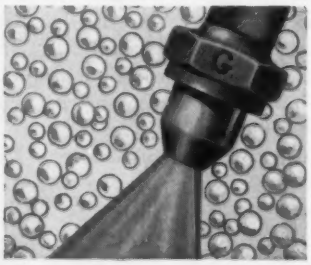
Mulsifyre installation protecting a 105 MVA transformer at the newly completed, modern Cromby Station of Philadelphia Electric Company, Phoenixville, Pa.

It was back in 1937 that Philadelphia Electric Company installed its *first* Grinnell system of Mulsifyre Protection.

The record achieved in the intervening years speaks for itself . . .

During the past 19 years, Philadelphia Electric Company has authorized Mulsifyre Protection for 28 different stations and sub-stations in its far-flung operation. This "repeat business", from a single user, is evidence of unsurpassed performance.

If *your* transformers are not protected by this effective emulsion-forming spray system, don't take chances. Get quick-acting Grinnell Mulsifyre. Complete extinguishment of fires within areas protected with Grinnell Mulsifyre sprays usually is obtained in a matter of seconds after the water discharge starts. For full details, write Grinnell Company, Inc., Providence, R. I. Offices in principal cities.



GRINNELL *Mulsifyre*

EMULSION-EXTINGUISHMENT OF OIL FIRES

BOOKS

(*Continued from page* 222)

some knowledge of electronics but little experience in acoustics. Bibliography and references guide the reader to more extensive study.

Power sales engineers involved in the application of manufacturing processes and testing methods by industrial customers would find this book helpful. And station operating and design engineers could acquire background to facilitate their analysis of sonic tests on major equipment.

How to Run Reactors

Control of Nuclear Reactors and Power Plants. By M. A. Schultz. Published by McGraw-Hill Book Co, 330 West 42nd St, New York 36, N. Y. 313 pages, illustrated. Price $7.50.

This book is the first published on this subject. The approach is from the viewpoint of servo engineering, thus making it necessary for the reader to know this subject thoroughly if he is to completely understand the book. The author first presents certain phases of basic nuclear physics that relate to the problem of reactor control. Then the new problems of reactor control in a power plant are presented. Remaining portions of book are devoted to solution of the control problem, control mechanisms and actual operation of reactor power plants. The author relies heavily on graphs and charts to get his material across.

This book will be valuable to engineers and scientists designing power reactors and to engineers who must eventually operate them. Of particular interest to utility engineers is the fact that all phases of operation—start up, steady state, and shut down—are completely discussed. A chapter is devoted to each of these operating situations.

How to Make System Studies

Elements of Power System Analysis. By William D. Stevenson, Jr. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. 381 pages, illustrated. Price $7.50.

Unusual clarity marks coverage in this book of power line parameters, steady-state transmission, fault calculations, and transient stability. Many illustrative examples are presented in detail with explanation of each step.

Primary use will be as a text for electrical engineering students in senior and graduate courses. Its suitability seems well tested by use of the original material in note form for several years. But young utility engineers who find themselves involved for the first time in system studies would find that home study of this book facilitates their grasp of such analyses.

EXCEEDS CLASS III SPECIFICATIONS

Wet or dry, pick your flashover test, NEW Kimble *Tempered* Glass insulators show flashover resistance exceeding A.I.E.E. requirements. In puncture tests, too, *Tempered* Glass insulators are outstanding. It has proved impossible to puncture them in air, even under the most severe maximum voltage impulses applied. Four years of field testing on more than 500 miles of line have produced no puncture failure. Even lightning surges have failed to damage them.

If it's on the pin, it's in service

In the event of shattering due to severe mechanical shock, insulator disintegrates into many small, non-sharp fragments. Trouble shooters can locate broken insulators—fast.

What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. It's a Kimble production method that gives Kimble insulators a hard-compression surface layer that makes them strong enough to meet the severe test required. This great strength saves installation time because it's never necessary to loosen for line up with the conductor—they can always take another quarter-turn.

Why not see how *tempered* glass can cut your line maintenance costs. Write for folder. Address: Kimble Insulator Division, Owens-Illinois, Dept. EW-3, Box 1035, Toledo 1, Ohio.

KIMBLE INSULATORS
AN (O) PRODUCT

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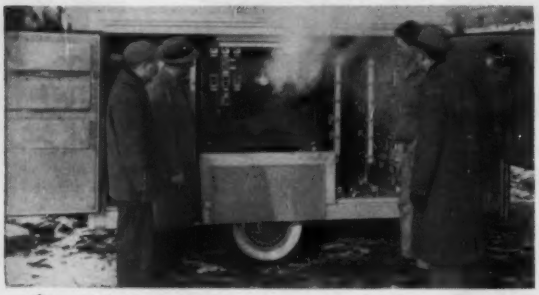
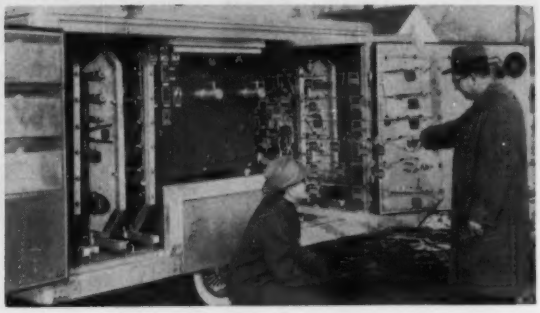


DEMONSTRATIONS show conductor burn-off time

ROLL-OUT PANELS simplify product display



Kaiser Trailer Displays Aluminum Products

Kaiser Aluminum & Chemical Sales, Inc, recently announced plans for a nationwide tour with a new trailer designed especially for Kaiser to display and demonstrate aluminum products.

Aluminum conductor, connectors and clamps are featured. They are mounted on six rectangular racks which pull out like file drawers and facilitate the product display. All manufacturers of aluminum connectors and clamps were invited to supply samples.

A gas-engine-driven generator supplies up to 5,500 w for test purposes. Demonstrations include tests on aluminum wire to show burn-off time and the characteristics of different types of insulation.

A tape recorder and public address system make it easy to handle group demonstrations.

The trailer will be used at industry meetings, conventions and exhibitions. It will travel through Kaiser Aluminum's sales districts.

Kvar-Kw Ratio 35% for 1955, Says GE

The ratio of kilovars to peak load kilowatts in the nation reached 35% at the end of 1955, according to the General Electric Co's Capacitor Department.

W. G. Hart, manager—power capacitor sales, said the total of power capacitor installations rose from 29.2 million kvar at the end of 1954 to an estimated 34.5 million at the close of 1955, an increase of 18%. The nation's peak load rose from 88.7 million to approximately 100 million kw in the same period, an increase of 13%, according to the GE manager.

Hart said GE's market studies indicate that capacitor installations for power factor improvement will continue to grow faster than peak load. The kilovar to kilowatt ratio will reach 50% in 1965, he predicted. The ratio was 33% at end of 1954.

Hart's figures include power factor capacitors on utility and industrial power systems but not capacitors that are part of power consuming equipment, such as motors and room air conditioners.

Westinghouse Expands Electronics Facilities

Ground was broken March 2 for a new warehouse to handle the expanding electronic tube business of Westinghouse Electric Corp. The warehouse will add 120,000 sq ft of floor space to the existing 450,000-sq ft plant building, located at Elmira, N. Y. Color TV tube production facilities are being added.

R. T. Orth, vice president, Electronic Tube Division, stated that the purpose of the expansion is to keep pace with the increasing electronics market and to provide more efficient customer service.

CF&I Expansion Involves Outlay of $23 Million

Colorado Fuel & Iron Corp, New York, plans to spend by June 30, 1956, about $23 million on plant modernization and development, advised A. F. Franz, CF&I president.

At the John A. Roebling's Sons Corp plants, Roebling and Trenton, N. J., projects completed and others in progress include new power facilities, new equipment for the electrical wire and cable department, new wire drawing machines, and related finishing facilities.

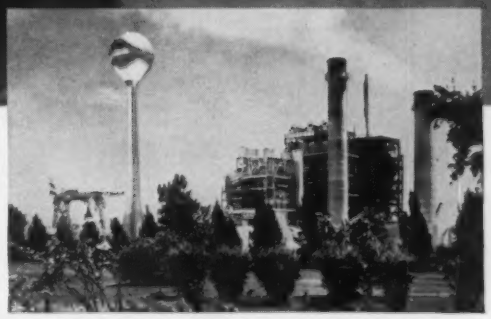
At other plants, Buffalo, N. Y.; Claymont, Del.; Clinton and Palmer, Mass.; and Pueblo, Colo., some outstanding projects are: Increasing capacity of open hearth furnaces, improving rod, tubing and casing mills, wire and wire rope facilities, and installing new wire drawing equipment.

(*More M&M on page* 230)

Nerve center

OF THE GIANTS THAT POWER FLORIDA'S GROWTH

Speedomax Telemeters help provide speed and accuracy in load frequency control at Florida Power & Light Company's Load Dispatcher's Office in the Ryan Building, Miami.



Cutler Plant, one of FP&L's eight plants controlled by L&N equipment.

Fast growing Florida Power & Light Company uses L&N automatic load frequency control equipment

• Rapidly expanding Florida Power & Light Company is growing even faster than the expanding area which it serves . . . is in the 4th year of a $410,000,000 construction program to provide 1,662,000 KW capability by 1961.

Key part of FP&L's mammoth expansion program is the installation of finest equipment for maximum efficiency and lowest cost operation. Particularly vital is the fast, accurate L&N equipment that controls the ebb and flow of power to meet varying demand.

L&N Speedomax Telemeters offer many advantages: work well with telephone, microwave or carrier channel, over any distance the channel can span . . . can be supplied to retransmit, to integrate, to add up area generation, net interchange, etc. . . . work directly with L&N Load-Frequency Control, and are engineered as an integral part of system control.

Your Load Dispatcher's Office can profit from L&N equipment. For details, write to Leeds & Northrup Co., 4938 Stenton Avenue, Philadelphia 44, Penna.

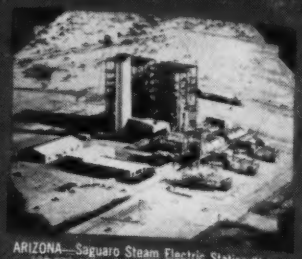
FLORIDA—Cutler Steam Electric Station (Unit 6) —125,000 kilowatts—for Florida Power & Light Company

GREECE—Ladhon Hydroelectric Development (Units 1 & 2)—50,000 kilowatts—for The Kingdom of Greece

GREECE—Corinth 150 KV Substation—for The Kingdom of Greece

MISSOURI—Hawthorn Steam Electric Station (Unit 4)—100,000 kilowatts—for Kansas City Power & Light Company

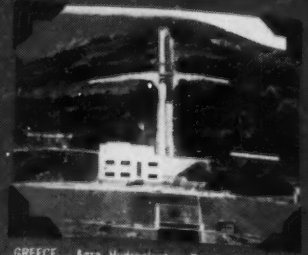
PENNSYLVANIA—Renovation of office building lobby—for Duquesne Light Company



ARIZONA—Saguaro Steam Electric Station (Unit 2) —100,000 kilowatts—for Arizona Public Service Company

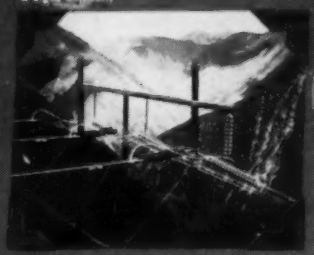
TEXAS—Deepwater Steam Electric Station (Unit 7) —156,250 kilowatts—for Houston Lighting & Power Company

NORTH CAROLINA—Cooling Pond for the Lumberton Steam Electric Station—for Carolina Power & Light Company

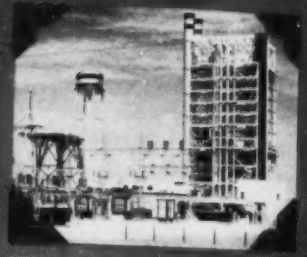


GREECE—Agra Hydroelectric Development (Units 1 & 2)—40,000 kilowatts—for The Kingdom of Greece

NORTH CAROLINA—Louis V. Sutton Steam Electric Station (Unit 2)—100,000 kilowatts—for Carolina Power & Light Company



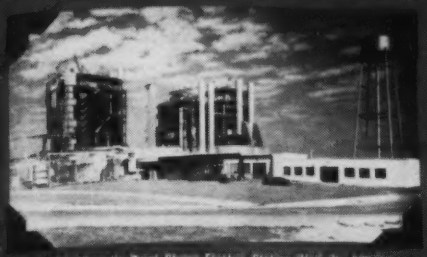
PERU—Paucartambo-Carhuamaya 100-mile 138 KV Transmission Line—for Cerro de Pasco Corporation



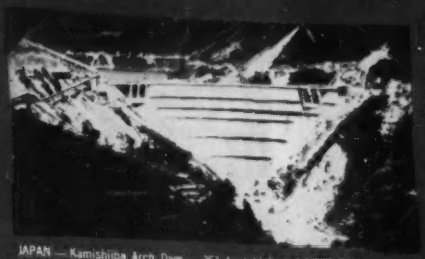
TEXAS—Collin Steam Electric Station (Unit 1)—145,500 kilowatts—for Texas Power & Light Company

more pages for

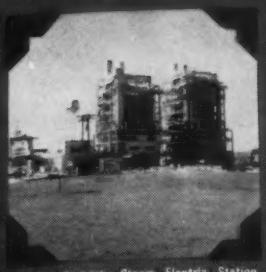
's album



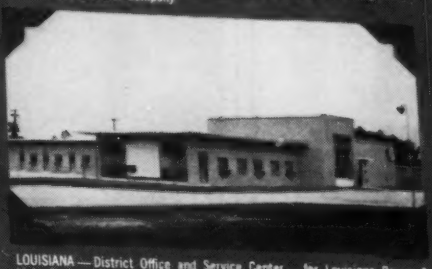
LOUISIANA—Ninemile Point Steam Electric Station (Unit 3)—125,000 kilowatts—for Louisiana Power & Light Company



JAPAN—Kamishiiba Arch Dam—361 feet high and 1,000 feet long—for Kyushu Electric Power Company

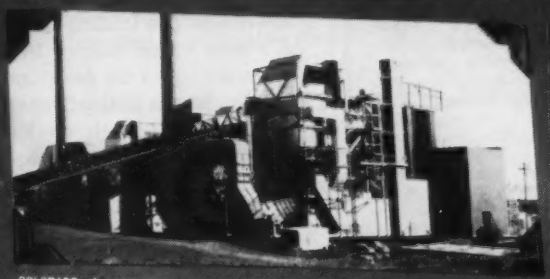


TEXAS—Parkdale Steam Electric Station (Unit 2)—100,000 kilowatts—for Dallas Power & Light Company



LOUISIANA—District Office and Service Center—for Louisiana Power & Light Company

GREECE—Over 800 miles of 155 KV Transmission Lines—for The Kingdom of Greece



COLORADO—Arapahoe Steam Electric Station (Unit 4)—100,000 kilowatts—for Public Service Company of Colorado

Some of Ebasco's services are listed below:

Appraisal · Consulting Engineering
Design & Construction · Financial & Business Studies
Industrial Relations · Insurance, Pensions & Safety
Purchasing, Inspection & Expediting · Rates & Pricing
Research · Sales & Public Relations · Space Planning
Systems, Methods & Budgets · Tax · Washington Office

# of achievement

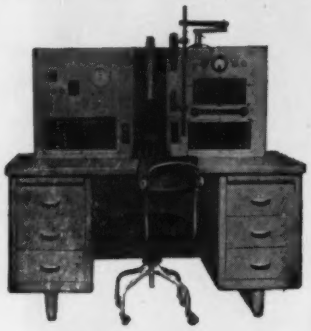
NEW YORK • CHICAGO • DALLAS
PORTLAND, ORE. • WASHINGTON, D. C.

OVER 200 MILLION DOLLARS OF CONSTRUCTION PLACED IN SERVICE IN 1955

On these pages are shown eighteen major engineering and construction projects placed in service by Ebasco during the past year. In addition to these, work was in progress on 76 projects which are scheduled for completion at later dates.

Ebasco provides a complete range of engineering and construction services for all types of industries. If you are thinking of new construction, why not send for our booklet, "The Inside Story of Outside Help." It outlines the many services we offer business and industry in all parts of the world.

Write: Ebasco Services Incorporated, Dept. Q, Two Rector Street, New York 6, New York.



Save time testing watthour meters with the

KNOPP

Meter-Testing Equipment, Type TE-7

Power companies the nation over, save time, save money, and build customer goodwill when testing watthour meters with the Knopp Meter-Testing Equipment.

Has Knopp Uniload† System with Unilink† series-test feature enabling testing of both elements of a 3-wire, single-phase meter simultaneously without opening the potential link.* Basic constant of rotating standard adjustable to match basic constant of meter-under-test.* Its new, more-convenient switching arrangement for connecting meter elements permits 2-element and 3-element polyphase meter testing without changing connections. Includes photoelectric counter and other time-saving features for accurate testing.

Tests all types of watthour meters. Provides voltage ranges of 120, 240, and 480; current ranges of .25, .5, 1, 1.5, 2.5, 5, 10, 15, 25, and 50. Overall equipment accuracy within .05%.

* *Patented* † *Trademark*

KNOPP Phase Shifter

You can have any leading or lagging phase angle by manually controlling the position of the rotor. One scale shows degrees for electrical angle of displacement; another, corresponding power-factor values. Gives true power-factor readings under all conditions. Highly accurate. Input: 120/240 v, 3-phase, delta. Output: 120 or 240 v, 3-phase, delta. Other ratings available.

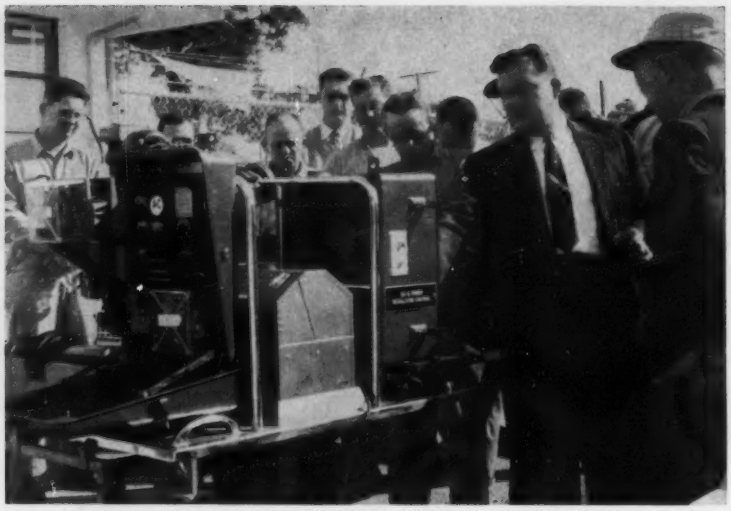
Also: Knopp Precision Transformers; Knopp Uniload Equipment for testing instruments and instrument transformers.

For complete technical descriptions please write us today

KNOPP INC.

Founded in 1928 by Otto A. Knopp under the name of Electrical Facilities Inc.

4236 Holden St., Oakland 8, Calif.



Mobile School Supplies Regulator Data

Operating and maintenance personnel of utilities in all sections of the country are being supplied with first hand information on the construction and application of Allis-Chalmers Mfg Co's step voltage regulators by means of a mobile training school.

A station wagon manned by Allis-Chalmers engineers is equipped with varied material for the presentations.

Carried in the station wagon are large photographs of untanked and tanked regulators, their mechanisms, and controls. Actual equipment shown includes quick-break tap-changing mechanisms, control panels, integrator, bushing assembly, Vari-Amp position indicator, and voltage regulating relay.

In addition, a slide projector and a sound movie projector are also employed. A set of instruction books, bulletins and engineering and service manuals are made available.

Radio Corp to Market Electronic Test Apparatus

Introduction of 13 different instruments will mark Radio Corp of America's entry into the field of electronic test equipment for industrial and laboratory applications, stated Arthur L. Malcarney, general manager, RCA Commercial Electronic Products.

The precision units will be placed on the market in about 30 days by RCA, Malcarney said. RCA will appoint manufacturer's representatives or distributors in each major market area. The instruments are:

A pulse generator featuring a rise time of 0.01 microsecond.

Two RF power meters capable of measurements from 5 microwatts to 5 watts, operating up to 1,000 and 10,000 megacycles.

Two null-reading dc voltmeters for measurements up to 100 and 600 v.

A vacuum tube voltmeter for measurements to 1,000 megacycles, 32,000 v dc, and 1,600 v ac.

Two impedance bridges for measurement of inductance, capacitance, resistance, and power factor at 60 and 1,000 cycles.

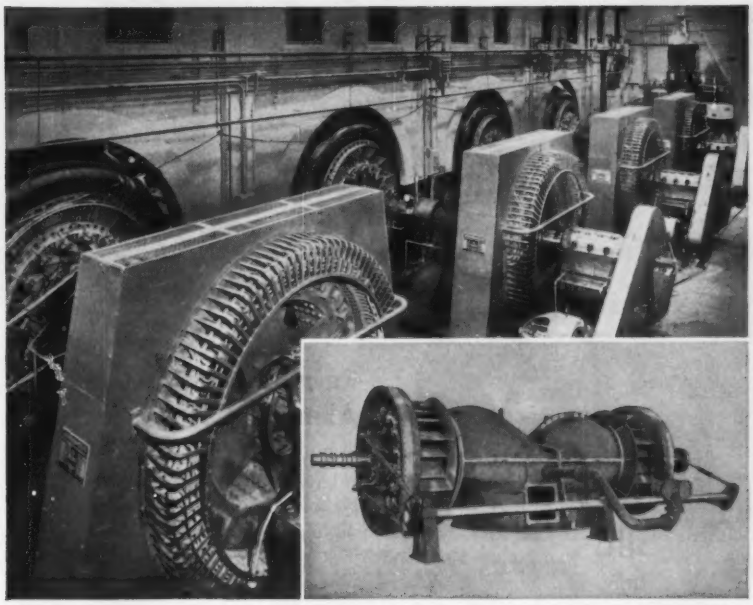
Four types of signal generators with ranges from 42 kc to 230 mc.

A deluxe multimeter which features a high sensitivity of 20,000 ohms per volt.

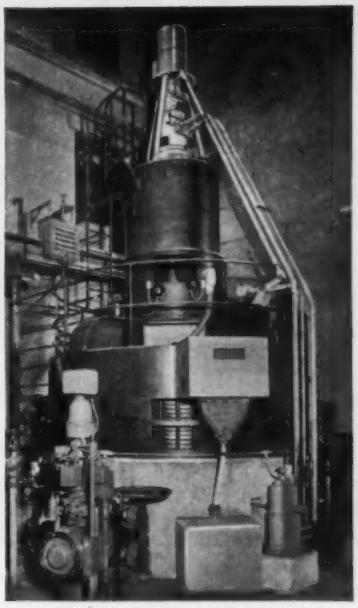
Fire-Training Course

Fourteen fire-training courses will be conducted this year on the 10-acre fire test field of Ansul Chemical Co at Marinette, Wis. The company-

(*Continued on page* 232)



Horizontal generating units are each driven by a pair of modernized SMS-Francis turbines shown (inset) during shop assembly.



At remote end of the power house, a vertical SMS-Kaplan unit, mounted in a concrete pressure flume provides flexibility of operation.

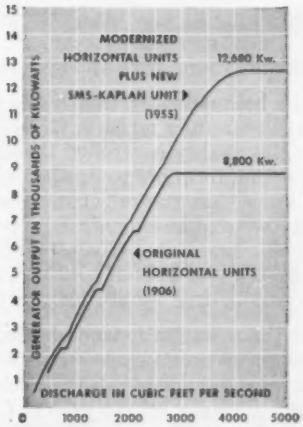
Consulting Engineers: Pioneer Service and Engineering Co., Chicago, Ill.

MINNESOTA HYDRO-PLANT WITH SMS TURBINE MODERNIZATION BOOSTS OUTPUT 35%

By completely modernizing a half-century-old horizontal turbine installation having the inside type of gate mechanism, the Upper Midwest's largest utility has raised the potential KWH output over 35%. This resulted from increased plant efficiency and greater installed capacity. The rebuilding program was a result of careful engineering studies made over several years by SMS in cooperation with the utility and their consultants with whom the purchase of modernized horizontal turbines was finally negotiated.

Four pair of horizontal SMS-Francis wheels with motor operated outside gate mechanisms were mounted on new 9-foot draft chests in the existing 14-foot diameter top supply pressure cases. An additional SMS-Kaplan turbine, rated at 3,500 HP under the 48-foot head, was added to provide flexibility and take load variations at a high efficiency over a wide operating range.

Whether your interest is modernization or a new station, you can rely on the broad engineering background of 80 years' experience available to you at SMS. For information on hydraulic turbines and accessories, write S. Morgan Smith Co., York, Penna.



Performance of modernized units based on index tests run in January 1956. Performance of original units based on guarantees when new.

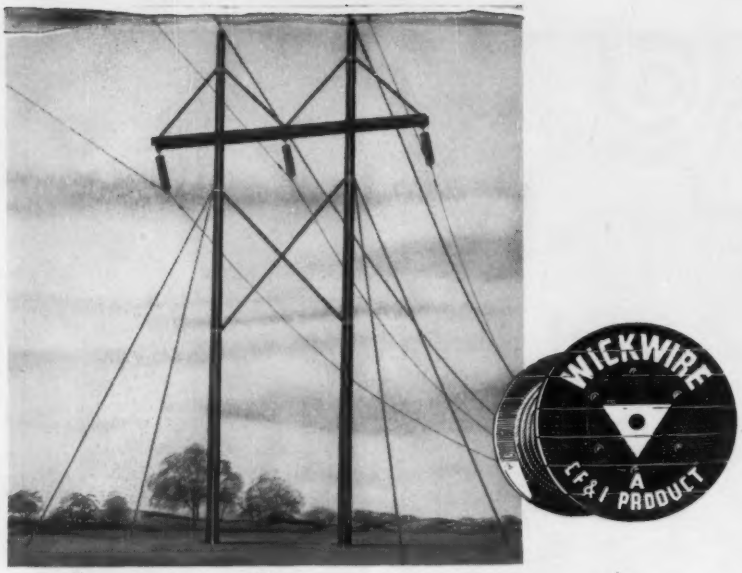
S. MORGAN SMITH

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

HYDRAULIC TURBINES · GATES & HOISTS · TRASH RAKES · PUMPS · ACCESSORIES

HYDRODYNAMICS

ROTOVALVES · FREE DISCHARGE VALVES · BALL VALVES · CONTROLLABLE-PITCH SHIP PROPELLERS · BUTTERFLY VALVES



for guy wire. . .messenger wire. . .
ground wire. . .use strong, dependable

CF&I GALVANIZED STEEL STRAND

There's a CF&I 7-Wire* Galvanized Twisted Steel Strand that's ideally suited for every guy, messenger or overhead ground wire application.

That's because every length and type of strand sold by CF&I is carefully made in CF&I's own mills—carefully quality controlled throughout *every* stage of production from ore to finished product. As a result, you know that you're getting steel that has exactly the right chemical and physical properties to do the best job for you . . . and that this steel is carefully drawn, galvanized and stranded into a product that'll give trouble-free service for years to come.

Next time you need strand—whether it's for guy wire or overhead ground wire—be sure you contact the nearby CF&I Representative. He'll be happy to give you complete details on the type of CF&I Strand that's best for your job.

NEED A GUY OR MESSENGER WIRE? Then use CF&I Strand that's made to meet or exceed ASTM Specification A-122 (latest revision).

NEED AN OVERHEAD GROUND WIRE? Then use CF&I Weldless Strand that's completely free of welds or joints of any kind in either the individual wires or the finished strand. Fully meets or exceeds ASTM Specification A-363 (latest revision).

3739

*Also available in 3-wire constructions.

CF&I

WICKWIRE SPENCER STEEL DIVISION · Atlanta · Boston · Buffalo · Chicago Detroit · New Orleans · New York · Philadelphia

THE COLORADO FUEL AND IRON CORPORATION · Albuquerque · Amarillo Billings · Boise · Butte · Casper · Denver · El Paso · Ft. Worth · Houston Lincoln (Neb.) · Los Angeles · Oakland · Oklahoma City · Phoenix · Portland Pueblo · Salt Lake City · San Francisco · Seattle · Spokane · Wichita

Fire-Training Course

(*Continued from page* 230)

sponsored course is open to representatives of industry and government on a first-come, first-served basis. The three-day courses, limited to 25 persons each, are scheduled as follows: May 21-23; June 4-6, 11-3, 18-20, 25-27; July 9-11, 16-18, 23-25, 30-Aug. 1; Aug. 20-22; 27-29; Sept. 17-19, 24-26; Oct. 8-10.

Reynolds Metals Plans Aluminum Expansion

Reynolds Metals Co plans a $43 million expansion (1) for more than 50% production increase of the alumina plant near Corpus Christi, Texas, and (2) for enlarging the aluminum sheet rolling mill at Sheffield, Ala. J. Louis Reynolds, executive vice president, said that it is necessary to increase alumina production to supply requirements of the new 200 million lb aluminum reduction plant to be built adjacent to the Reynolds northern Alabama operations.

In addition Reynolds will spend $25 to 30 million at the La Quinta, Texas, plant to increase aluminum from 1,000 to 1,500 tons daily.

Reynolds has a contract to deliver 320,000 tons of primary aluminum to Ford Motor Co in the next 10 years.

ASA Reports Status of New Study Projects

The American Standards Association reports on the following subjects:

Potheads for Terminals—A subcommittee has been organized to handle work recently included in the scope of Committee C8-Insulated Wire and Cables. This subcommittee will consider AIEE standard No. 48 on potheads. The latter standard is under revision by the AIEE Insulated Conductor Committee.

Wire and Cable—A standard is being considered for weather-resistant wire and cable, polyethylene type, C8.35. Also under consideration is a revision of American Standard Specification for Weather—Resistant (weather proof) Wire and Cable

(*Continued on page* 234)

For the Maximum in Fly Ash Recovery...

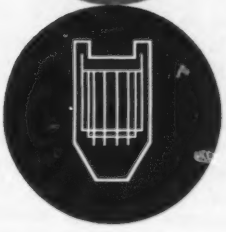
... an unbiased recommendation from

WESTERN PRECIPITATION

The only organization with 48 years of dust collection experience.

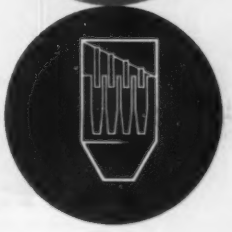
ELECTRICAL, MECHANICAL *and* CMP *types of recovery systems.*

COTTRELL *Electrical* PRECIPITATORS



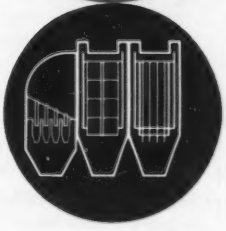
Western Precipitation pioneered commercial application of the now-famous Cottrell **Electrical** Precipitator—has more know-how, more experience, more basic advancements in this highly-technical electrostatic field of recovery than any other organization, domestic or foreign.

MULTICLONE *Mechanical* COLLECTORS



Western Precipitation pioneered the multiple small tube type of cyclonic collector—the type with higher centrifugal forces for greater recovery efficiencies. Multiclones are also easier to install, service and maintain—and require less space than other equipment of comparable capacity.

CMP *Combination* SYSTEMS!



Western Precipitation pioneered the CMP (**C**ombination **M**ulticlone-**P**recipitator) type of recovery unit now favored by so many leading power plant operators—the unit that combines advantages of both the Mechanical and Electrical principles, and provides almost constant collection efficiency despite varying gas volume.

Plus **invaluable know-how**

The most important part of **every** Western Precipitation installation is this organization's unequalled experience gained through almost a half-century of continuous leadership in the highly-complex science of recovering suspensions from industrial gases. No other organization—anywhere—offers such seasoned judgment in Electrical, Mechanical and CMP recovery methods. Yet you pay nothing extra for this invaluable "know-how"!

Let us send you literature which describes Western Precipitation's unique services in greater detail. Write, wire or phone our office nearest you!

COTTRELL Electrical Precipitators
MULTICLONE Mechanical Collectors
CMP Combination Units
DUALAIRE Reverse-Jet Filters
HOLO-FLITE Processors

Western Precipitation Corporation

Designers and Manufacturers of Equipment for Collection of Suspended Materials from Gases and Liquids

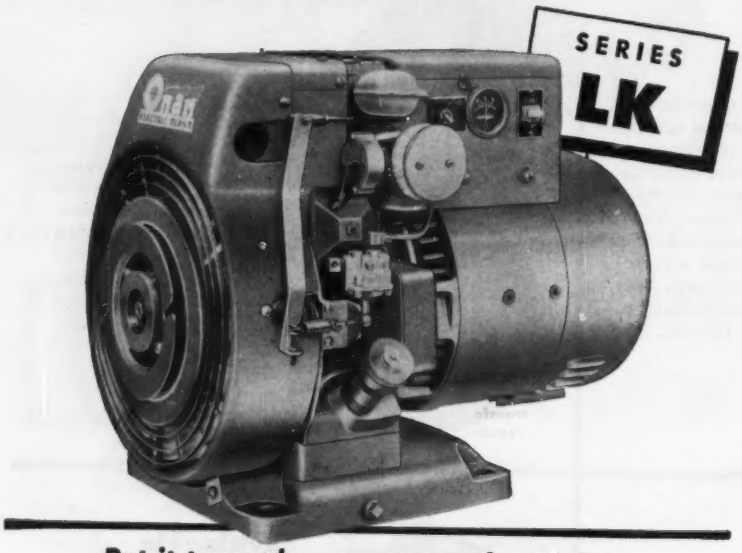
Main Offices: **1004 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA**

Chrysler Bldg., New York 17 • 1 North La Salle Street Bldg., Chicago 2 • Oliver Bldg., Pittsburgh 22 • 3252 Peachtree Rd. N. E., Atlanta 5 • Hobart Bldg., San Francisco 4 • Precipitation Co. of Canada Ltd., Dominion Sq. Bldg., Montreal

RUGGED

is the word for this

New ONAN 2-KW Electric Plant



Put it to work on your toughest jobs!

PORTABLE POWER

Stands up better under rough handling. Carrying -frame or 2-wheel dolly optional.

PRIMARY POWER

Runs longer in continuous day-after-day service. Dependable, economical.

A dependable source of electricity for emergency standby use

Built to do the job where other units won't stand up! This new 2,000-watt, A.C., 115 or 230-volt, gasoline-driven Onan plant can take all kinds of punishment and come back for more. It's powered by a husky, Onan 4-cycle, single-cylinder, engine with Stellite-faced rotating exhaust valve, larger longer-wearing bearings, and efficient, trouble-free air-cooling. The Onan-built generator is direct-connected, permanently aligned, and fully-protected for use under all climatic conditions.

The Onan "LK" is compact too . . . requiring less than 3 square feet of floor space. Heavy-duty construction throughout . . . yet it weighs only 235 pounds. In carrying frame or dolly-mounted it can be taken anywhere and is easily moved around on the job.

The rating of 2,000 watts is conservative, allowing ample overload. Fuel consumption at full rated load is less than one quart of gasoline per kilowatt hour, making the "LK" a low-cost source of primary power. Recoil rope starter on models for portable use; electric starting available for stationary installations; automatic controls for emergency standby use.

Wide range of accessories available

Write today for special "LK" folder!

D. W. ONAN & SONS INC.

Onan ELECTRIC PLANTS

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New ASA Projects

(*Continued from page* 232)

for general purposes, C8.12-1942, has been submitted to a sectional committee. Action by letter ballot is the next step.

Machine Tool Electrical Standards —withdrawal is considered for American War Standard, Machine Tool Electrical Standards, C74-1942. It is reportedly obsolete.

Sound Level Meters—A new edition of American Standard Specification for Sound Level Meters, Z24.3-1944, is under consideration by a sectional committee.

Seminars for Executives Outlined in New Brochure

"Invitation to Learning" is a new brochure which outlines the seminars offered by Remington Rand Institute to business executives interested in business systems and equipment.

The eight-page illustrated booklet describes the objectives, general procedures, and subject matter of the different seminars. There are sessions for executives and department heads interested in punched-card or electronic methods; others for top-level persons from many firms to discuss general management problems; and seminars for members of one firm to attack a specific problem.

Copies of the brochure (X-1630) are available at Remington Rand sales offices in principal cities or at Remington Rand Institute, 315 Fourth Ave., New York 10, N. Y.

FPE Electronic Trainer

Federal Pacific Electric Co, Newark, N. J., has developed an electronic trainer for presentation of basic and advanced electronics in class rooms. The dynamic training aid provides visual demonstration of actual current, voltages and waveforms. Capacitance, inductance and resistance may be varied through the use of plug-in components. Resultant change in characteristics of circuits is shown on an oscilloscope screen and associated meters.

(*M&M Briefs on page* 235)

M&M BRIEFS

Stock Split—Allis-Chalmers Mfg Co and Revere Copper & Brass, Inc, are planning a 2-for-1 split of the common stock.

General Electric Co has announced these recent developments:

• Howard E. Grantz, manager of small power plants and components engineering for GE's atomic power equipment department, declared recently that his organization, formed in Feb. 1954, has more than tripled in size. To help achieve flexibility, an intensive training program is carried out and definite goals are written down.

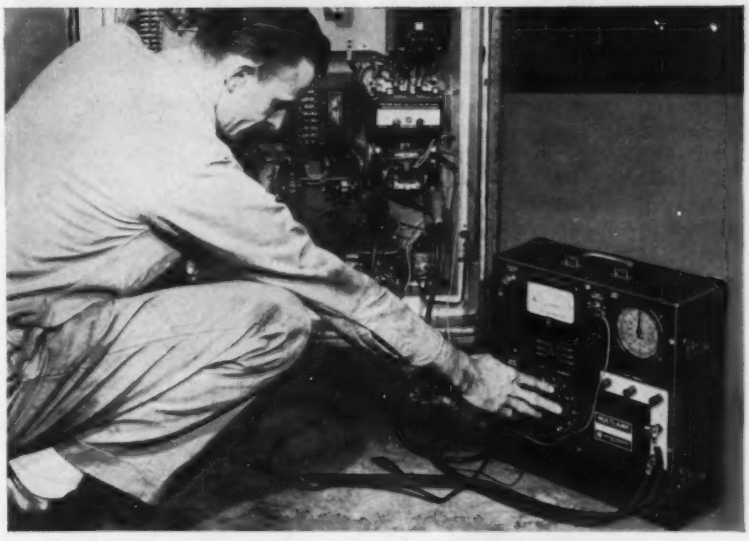
• Two mobile unit substations, each 7,500 kva and believed to be the largest built for over-the-road use, are being shipped to Illinois Power Co. Rated h-v, 69 and 34.5 kv; 1-v, 13,-090Y, 7,560, 4,360Y and 2,520 v, each unit (trailer included) weighs 25.5 tons and is 31 ft long, 8 ft wide and 13 ft high. With the tractor, the rig will be 45 ft long and weigh 33 tons—under the Illinois State highway limits of 50 ft and 35 tons.

General Dry Batteries, Inc, Cleveland, has reported setting up eleven warehouses across the nation. All battery shipments are to be made in 48 hr from the warehouses at Atlanta, Boston, Cleveland, Dallas, Denver, Dubuque, Los Angeles, Memphis, Portland (Ore.), San Francisco and Silver Spring (Md.) The company produces mercury batteries for low-drain use such as electronic equipment. Most of the lines are being handled by manufacturers representatives.

Redmond Co, Inc., manufacturers of fractional horsepower motors, will have a new plant at Angola, Ind., in operation about May 1. James W. Tweedy, president, stated that the product of this plant will be a new motor designated Tpye AL-4. The motor will have applications in heating, refrigeration, ventilating, air conditioning, and appliance fields.

Precision Transformer Corp has moved to new office and plant facilities at 2218 W. Lake St, Chicago, Ill. The firm said the move permits expansion of its line of air-cooled and liquid-filled transformers.

NOW... test any relay accurately, quickly on the line with MULTI-AMP®



Portable, Easy-to-Operate, Complete for Your Needs!

This convenient loading transformer type instrument, series 1004, saves hours per test on set-up time now required with old-fashioned load boxes.

Once and for all take the guess work out of testing your protective relays, motor starter overload relays, oil circuit reclosers or breakers and *any other current actuated protective device.* With any versatile Multi-Amp model, you test *under conditions equal to actual operating performance* . . . and you know exactly how each piece of equipment measures up to the job it is supposed to do!

A simple maintenance check with Multi-Amp reveals faulty protective devices immediately. It prevents costly equipment losses, avoids the confusion caused by breakdown emergencies and eliminates work stoppages with their subsequent 'downtime' wastes

MULTI-AMP test instruments range from compact 0.4 KVA models to custom-designed 500 KVA units. You can be sure there's a suitable MULTI-AMP for your specific needs.

ACTS Series

Equipment for testing, calibrating and coordinating: • Oil Circuit Reclosers and Breakers • Motor Starter Overload Relays • Induction Disc Relays • CSP Transformer Breakers • Sectionalizers *and any other current actuated protective device up to 500 KVA*

"Take the guess work out of electrical protection"

For details on the advantages of Multi-Amp test instruments and a list of major power and industrial installations, MAIL COUPON.

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NEWS ABOUT PEOPLE

Hartford Electric Advances Gibson and Barker

Raymond A. Gibson, executive vice president of Hartford (Conn.) Electric Light Co, has been elected president of the company, according to a recent announcement by Austin D. Barney, chairman of the board of directors. Gibson succeeds Kenneth P. Applegate who retired from the company after 44 years service.

William S. Barker, general manager of the Hartford utility, was elected vice president and continues in his former post.

Gibson, a 1923 graduate of Rensselaer Polytechnic Institute with a degree in electrical engineering, began working for the utility 33 years ago. He had held posts of advertising manager, commercial manager, and assistant to the vice president. In 1945 he was named sales manager and became vice president in 1950.

R. A. GIBSON

W. S. BARKER

Barker is another Rensselaer Polytechnic Institute electrical engineering alumnus, class of 1917. He joined the company that year, and has since served in various positions, including clerk, chief clerk, and assistant purchasing agent. He became purchasing agent in 1929 and was appointed general manager in June, 1951.

Yankee Atomic Elevates Knapp, Coe, Johnson

Three vice presidents have been elected by Yankee Atomic Electric Co. They are Sherman R. Knapp, president of Connecticut Light & Power Co; Roger J. Coe, vice president of New England Power Co, and H. M. Johnson, chief district engineer, New England Power Service Co.

The announcement follows Atomic Energy Commission's approval of Yankee Atomic's petition to develop and construct the proposed generating plant in Rowe, Mass.

Knapp joined CL&P in 1928 following graduation from Cornell University with an engineering degree. He served as an engineer in the operating and sales department until 1937 when he became New Milford district manager. In 1941 he was named assistant to the sales vice president and in 1948 assistant to the president. His 1949 elevation to executive vice president was followed three years later by his election to the presidency.

Since coming to New England Power in 1926, Coe has served as distribution assistant, assistant electrical engineer of New England Power Service Co, assistant chief engineer, and New England Power Co engineer. In 1952 he was named assistant to the vice president and in mid-1955 vice president. He also served for a year as executive director of the Committee on Ordnance, Research and Development Board, Department of Defense, Washington, D. C.

A Rensselaer Polytechnic Institute electrical engineering graduate, Johnson joined New England Power as a tester in 1917, became chief meter inspector in 1920, and meter engineer in 1928. He has been chief district engineer since 1949.

S. R. KNAPP

R. J. COE

H. M. JOHNSON

FOR SPEED!

FOR ACCURACY!

USE BELL SYSTEM PRIVATE LINE TELETYPEWRITER SERVICE

Bell System private line teletypewriter service offers important advantages to those who operate the nation's power lines.

Teletypewriters are used for planning the day's operations, general written communications from load dispatcher to power plants, substations, other dispatchers, and offices.

The service ranges from a simple private line between two teletypewriters up to networks connecting many points. To meet the challenge of today's highly competitive market, you have *direct—fast—accurate—written—private—two-way* record communications.

Let a Bell System communications engineer make a detailed study of your communications. Such a survey may save you time and money. There's no obligation.

• ***Call your Bell Telephone representative***

BELL TELEPHONE SYSTEM

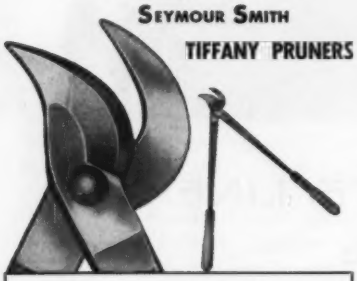
TELEPHONE TELETYPEWRITER TELEMETERING AND REMOTE CONTROL CHANNELS

Illustrated above is No. 11 Tree Pruner with center cut action by tempered steel blade that easily handles 1" branches. Head is reinforced malleable iron. Spruce poles with telescoping aluminum joints. For heavier work No. 12-18, capacity 1½". Also Pole Saws.

for clearing brush...

SEYMOUR SMITH

TIFFANY PRUNERS



Hand forged throughout. Fast and easy double cut action with thin blades shaped to "draw in." Improved bolt and nut joint, through handle and riveted grip fastening.

FAST-CUTTING SAWS

Blades of Swedish charcoal steel. Large, deep teeth with heavy set to prevent binding. Hand and Pole models for all work up to chain sawing.

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M. L. BLAIR

K. I. JACK

W. T. THRAILKILL

WWP Names 3 to VP Posts

Three Washington Water Power Co executives—Marshall L. Blair, Kimball I. Jack, and W. L. Thrailkill—have been given the title of vice president.

Blair, new vice president in charge of power supplies, joined Washington Water Power as a substation attendant in 1926. At the time of his recent appointment he was manager of the power supply department of WWP and a director of the Pacific Northwest Power Co.

Before elevation to his new position of vice president in charge of sales, promotion, and public information, Jack served as manager of the general sales, promotion, and information department since 1953. He came to the company in 1939 from Utah Power & Light Co to organize and manage the advertising and promotion department.

Thrailkill, who becomes vice president in charge of operations, joined WWP in 1933 as an engineer in the rate department. He was designated assistant general manager of the company in 1944. Before joining WWP he was assistant chief engineer of the Washington state Public Service Commission.

BullDog Elects Spurrell

New general sales manager for BullDog Electric Products Co is Merle P. Spurrell, former Midwest regional sales manager.

He succeeds Leo H. Lipscomb, recently named vice president, sales, I-T-E Circuit Breaker Co, BullDog's parent company.

Since joining the firm in 1940 Spurrell has been field engineer, Detroit district sales manager, and Wolverine Division sales manager.

M. P. SPURRELL

Engineers Honor Lucking

Title of Arizona's engineer of the year was recently bestowed on Walter T. Lucking, president of Arizona Public Service Co, by presidents of 13 Arizona technical societies.

His selection highlighted National Engineers' Week festivities at Phoenix, when he was presented a plaque by John Stufflebean, president of the Arizona Society of Professional Engineers.

W. T. LUCKING

PERSONAL BRIEFS

C. A. Thrasher, Jr, has been appointed to succeed the late **Walter T. Ackley** as general supervisor of area development for Ohio Edison Co. Replacing Thrasher as Bellevue district manager is **E. W. Hoermann,** previously commercial sales representative for the Akron Division.

Florida Power Corp has promoted **Joel T. Rodgers** to assistant chief mechanical engineer.

Gulf States Utilities Co has named **Glenn E. Richard,** formerly assistant treasurer, as treasurer to succeed **H. V. Faber,** who has resigned from that post but continues as a vice president. **George W. Dunlop** moves up from chief clerk to assistant treasurer.

H. C. Vincent, Columbus & Southern Ohio Electric Co vice president and treasurer, has been elected a director. New executive committee member is **J. L. McNealey,** vice president in charge of operations and a director. Both vacancies resulted from the death of **J. B. Poston** in January.

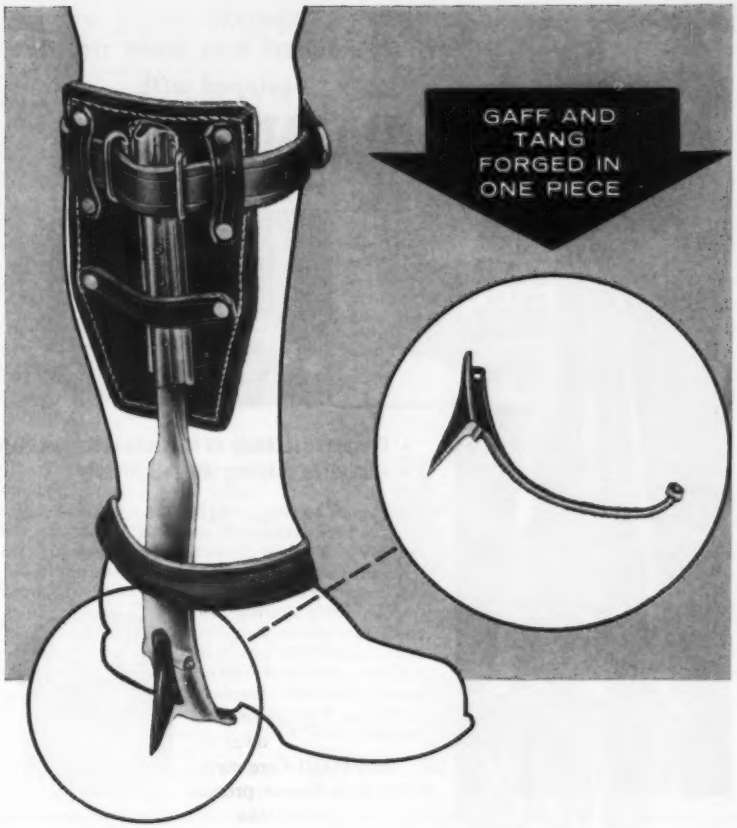
Dr. Fulton Cutting, professor of physics and assistant to the president of Stevens Institute of Technology, has been made a fellow of the American Institute of Electrical Engineers for "his services to electronic engineering in the fields of research, management, and education."

Wade H. Wright, a member of the board of directors of Georgia Power Co, was recently awarded a pin in recognition of his 50 years service with the company. He is former secretary, assistant to the president and a vice president of Georgia Power.

Michael Dingman, formerly sales representative for Pfaff & Kendall, has been appointed sales manager for Micro Balancing, Inc. He will handle sales and promotion of the company's Lumatrol line of photo-electric street light controls.

Pennsylvania's **Gov George M. Leader** has named **Joseph Sharfsin,** former Philadelphia city solicitor, a member of the state Public Utility Commission. He succeeds **Thomas C. Egan,** whose term expired last April.

(*More Personal Briefs on p* 240)



Here's why M-S-A–Brooks Adjustable Climbers provide greater safety–durability

Gaff and tang forged in one piece! That's a statement that makes plenty of safety-sense to workers who depend on a small "tooth" of steel to support their weight high above the ground. This feature is exclusive with the M-S-A–Brooks Adjustable Climbers. And there's more to the story. The gaffs and leg irons are forged from high quality, medium carbon steel, heat treated to assure the proper balance of hardness, toughness and ductility.

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Pads and straps are made of top grain steer hide with chrome leather reinforcement on the leg side of the calf pad. The result—maximum comfort on the job.

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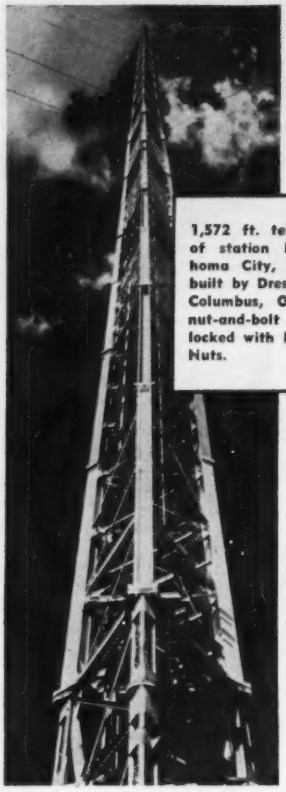

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equipped with
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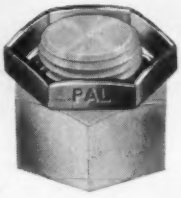
Trademark

1,572 ft. television tower of station KWTV, Oklahoma City, designed and built by Dresser-Ideco Co., Columbus, O., has many nut-and-bolt assemblies locked with PALNUT Lock Nuts.

- **Prevents loosening of nuts and bolts**
- **Eliminates checking and retightening**

For up to 20 years, PALNUT Lock Nuts have been universally specified on AM, FM, TV and signal Corps towers, and extensively used on transmission towers and sub-station structures. Low in cost, easily applied and absolutely secure. Hot dip galvanized to exceed ASTM specifications. Specify PALNUTS for your towers. Samples on request.



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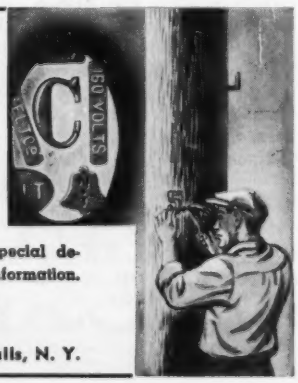

Far superior to old fashioned stencil marking methods. Premax embossed aluminum markers are now available for every type of pole, steel tower, transformer, switch and cable identification, plus markings for identification by aerial patrol. Both standard and special designs. Ask your jobber or write for complete information.

PREMAX PRODUCTS
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General Electric Co's newly created Industrial Computer Section will be headed by **H. R. Oldfield, Jr,** previously manager of GE's Microwave Laboratory, Palo Alto, Calif. As general manager, Oldfield will direct integrated and broadened computer line from Syracuse, N. Y., GE electronics headquarters. Managerial appointments for the section include **Kenneth R. Geiser,** engineering; **Clair C. Lasher,** marketing; and **George C. Trotter,** sales . . . New marketing manager for GE's home heating and cooling department is **Lawrence H. Hirschbach,** former builder and modernization sales manager.

New executive vice president of Development & Resources Corp, New York City, is **John Oliver,** assistant to the president of Wheland Co. The appointment becomes effective in April. Development & Resources Corp was formed by Lazard Freres & Co, **David E. Lilienthal,** and **Gordon R. Clapp** to provide organizational, technical, and financial guidance in the development of natural resources outside the U. S.

General Motors Corp has appointed **Ivan L. Wiles** as an executive vice president in charge of dealer relations. He has been general manager of Buick, a vice president of General Motors, and a member of its administration committee since 1948.

New president of General Radio Co is **Charles C. Carey,** vice president of manufacturing since 1944. He succeeds **Errol H. Locke,** recently retired.

Francis P. Gately has been designated auditor of Consolidated Edison Co of New York, Inc, to replace **Arthur Hald** who retired Feb. 29.

Advancement of **H. B. Alford** from chief service engineer to chief field engineer has been announced by Western Precipitation Corp. He will have responsibility for all service, construction, and inspection activities of the company throughout the U. S. and Canada. . . . Western Precipitation's new Precipitator Engineering Division chief is **H. H. Haaland,** who succeeds **D. H. Wheeler,** resigned.

R. L. Heinz, former Graybar Electric Co operating manager in Oklahoma City, has been named operating manager at Shreveport.

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Now: Like new!

G-E Service Shop

Your local G-E Service Shop uses mass-production methods when it rebuilds your old distribution transformers. Result: high-quality work at low cost . . . prompt pickup and delivery . . . and no worries for you. And you get new-unit warranties! There are 31 G-E Service Shops throughout the country—one near you. 431-32

Progress Is Our Most Important Product

GENERAL ELECTRIC

SALES ASSIGNMENTS

COMPANY STAFFS

Bristol Co has designated W. C. Van Leuven as midwest regional sales manager of its Socket Screw Division with responsibility for field sales management in the Detroit, Cleveland, Chicago, and St. Louis districts, with headquarters in Detroit. . . . Two new district managers for the company's Pittsburgh and Birmingham offices are, respectively, L. B. Lumpkin and W. C. Peterson.

Federal Pacific Electric Co's R. L. Bobo, regional sales manager, has been named manager of the Cleveland regional plant and will continue to serve as Great Lakes regional sales manager.

General Electric Co has appointed J. Gibson Henderson manager of general industries systems sales unit, Apparatus Sales Division, with headquarters in Schenectady. . . . Appointments in the sales component of the recently realigned marketing organization for GE's Large Steam Turbine-Generator Department include Daniel J. McLaughlin's promotion to manager of large steam turbine-generator sales for the New England, New York, Empire, Atlantic, East Central, Central, Michigan, Pacific Northwest, and Allegheny districts. Russell W. Miller assumes the same responsibilities for the Southeast, Mid-States, Southwest, Rocky Mountain, Pacific, Pacific Southwest, and Pacific Northwest districts. New specialists in sales engineering and sales training are George B. Cox and John E. Mulder. . . . Howard W. Arnold, formerly a Chicago area sales representative for GE's Carbolay Department, has been named manager of distributor sales in the Detroit area.

Kaiser Steel Corp, Oakland Calif., has appointed Elvan R. Babylon as manager of engineering sales.

Minneapolis-Honeywell Regulator Co's new retail sales manager, Home Products Division, is Alfred R. Howard.

Ray-O-Vac Co has appointed Wash N. Reynolds district sales manager to direct distribution in a three state district including sections of Tennessee, Alabama, and Georgia.

Riley Stoker Corp's John R. Delk has been designated sales engineer at the company's Philadelphia office.

Westinghouse Electric Corp has appointed Frank W. Loiko as national sales representative and James E. Kerman as manufacturing supervisor for portable appliances. Loiko, who succeeds Edward W. Rosenberger, will be responsible for headquarters contacts with a number of key distributors, and Kerman will coordinate all portable appliance manufacturing activities at the Mansfield, Ohio, and Springfield, Mass, plants. . . . Howard W. Grosh is new midwestern regional lighting sales manager with headquarters at Westinghouse's Chicago headquarters.

FULL POWERED
for faster, safer, easier operation!

CRANES

Utilities find the full powered operation of Gar Wood 2400 series cranes an important advantage in handling transformers, pipe, poles and large commercial appliances.

All operations—hoist, boom and swing—are fully powered and individually controlled by separate levers conveniently located at the side of the crane. Automatic swing cutouts prevent overswing. All these features add up to fast, simple operation... complete, full-time control... greater accuracy for spotting loads... maximum safety.

Gar Wood cranes are real space-savers, too. They require a minimum amount of space behind the cab... permit maximum payloads, do not interfere with regular use of body when crane is idle.

Gar Wood 2400 series cranes have a maximum capacity of 4.4 tons. Other series available with capacities from 1½ to over 8 tons. For complete information, see your Gar Wood-St. Paul distributor, or mail coupon below.

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Please send me free Bulletin No. WC-202R that describes Gar Wood truck-mounted cranes.

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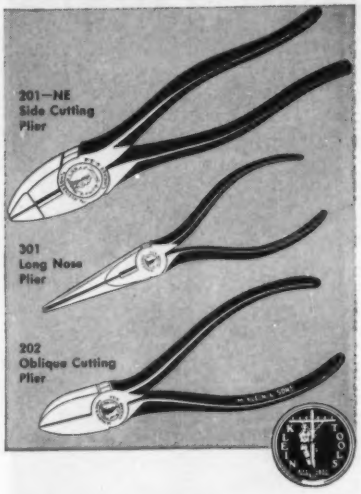

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Kleins have been serving the electrical industry since the first wires were strung and today have the same high quality, the same fine craftsmanship, the same individual inspection and testing that have won them their place for a century as first in pliers.

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Speed up Klein Plier sales with this new display board. Write for price and full information.

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Catalog Speeds M&S

(*Continued from page* 117)

typists once a week. No type is kept standing. But once a month revisions are promulgated. New material reproduced in the office service section goes to the stores accounting section for review, and all changed items are indicated by a stamped arrow. The office service section mails new pages to catalog holders. Its 600 pages are inspected periodically in the field by division stores supervisors, and storekeepers check their stock against descriptions.

Helps Purchasing

Purchasing personnel use the standard numbers and descriptions, finding them especially helpful in dividing their responsibilities. The purchasing department is now making operational two new robot-type visible card index units which will house price records for purchased materials. These are expected to save time in processing purchase requisitions and make more efficient the handling of volume purchases.

Price Information Available

By depressing a key, the operator causes the unit to select electrically a tray pertaining to a range of items and to position it for the work table in a few seconds. Record cards containing price information are quickly exposed, as well as records of purchases for each store item in the series.

All Bids Recorded

One robot-type visible card index unit has a capacity of 4,020 pockets, arranged in 60 trays, which houses 8,040 8 x 5-in. cards when front and back of pocket are used. For use with them, a new card has been designed which records the bids of every supplier. Actually each record consists of two index cards, arranged one above the other. On the upper card, description, remarks, and bids are recorded; on the lower, each purchase is entered. Price clerks thus obtain any desired information at a glance.

The file is being arranged according to the new numbering system. Items not handled through materials and supplies will be listed alphabetically at the end of the group with which they would be associated in the catalog. This adds to the value of the new system.

WALKER SELENIUM RECTIFIERS
INSTALL THEM — FORGET THEM
Engineered for Extra Years of
AC TO DC POWER CONVERSION

LOW COST, QUIET, HIGHLY EFFICIENT, LONG LIFE NO MAINTENANCE

Walker Selenium Rectifiers are engineered and built to give *extra* years of service and inexpensive operation. They are highly efficient, have a power factor of 97% and a DC ripple of approximately 4%. All Walker Rectifiers are low priced. Only the highest quality components are used. Any number of rectifiers may be paralleled. Write for full details, today.

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Cleveland's Big Budget Goes Over with a Bang

A bang-up reception greeted Cleveland Electric Illuminating Co's recent announcement of a $500-million expansion program.

Public Square manholes literally flipped their 100-lb lids when an explosion rattled windows and passers-by in downtown Cleveland a few hours after the company's plans were revealed. Traced to a faulty 240-v dc cable leading to CEI's terminal tower building, the blast caused damage estimated at $5,000. No injuries were reported but two women were treated for shock.

The 25-year-old lead-sheathed cable, one of three housed in a 4-ft sq subway leading from the company's building to the feed-in box for the terminal, supplied power for elevators. Engineers theorized that a crack in the lead sheathing bared insulation which was penetrated by moisture causing a short circuit. With little or no chance for any type of subway gas to have accumulated, engineers thought the smouldering insulation created enough pressure to cause the blow-out.

The errant cable won't have to be replaced.

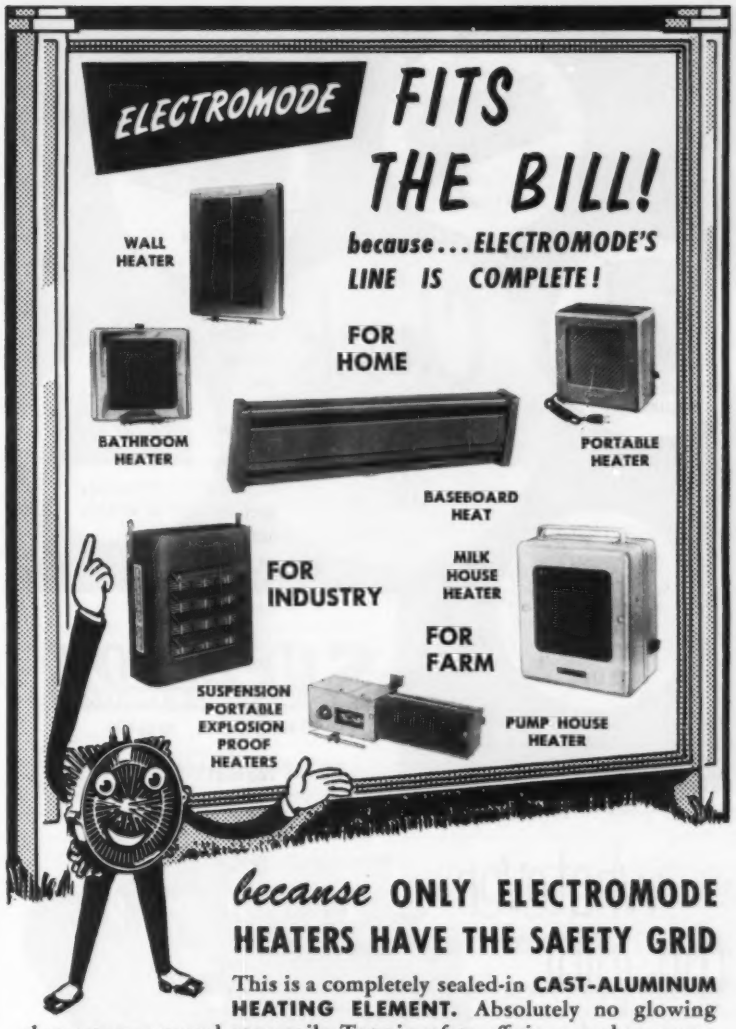
Adlai Stevenson Scores PG&E Partnership Plan

Pacific Gas & Electric Co proposal for a partnership arrangement with the federal government on the $225-million California Trinity River Project drew the fire of Adlai Stevenson, 1952 Democratic candidate for president, at a recent press conference in Sacramento.

Stevenson toured the state in the kickoff of his campaign to capture the 1956 Democratic convention's slate of California delegates in the June primary election.

"It is a pretty bad deal (in public projects) when the public gets the uneconomic part—flood control and reclamation—and private utilities get the profit making part—the electric power," Stevenson said.

The Bureau of Reclamation is studying the PG&E offer to build the power plants on the Trinity River and to buy falling water from the government reservoirs to operate the power facilities.



because ONLY ELECTROMODE HEATERS HAVE THE SAFETY GRID

This is a completely sealed-in **CAST-ALUMINUM HEATING ELEMENT.** Absolutely no glowing elements or exposed open coils. Tops in safety, efficiency and economy. The Electromode heating element is guaranteed for five years.

because ELECTROMODE LEADS IN ELECTRIC HEATING

ELECTROMODE
Division Of
COMMERCIAL CONTROLS CORPORATION

For more than a quarter century Electromode has concentrated on one specific industry—heating by electricity. From the beginning Electromode has pioneered for a quality product and has continued to expand its line to include the most modern developments in electric heating equipment to serve present day needs. As a result of Electromode's firm stand on quality, complete satisfaction has been the rule with those who either sell, install or use Electromode electric heating equipment.

MAIL COUPON TODAY

MAIL COUPON! Please send your FREE Electric Heating File, containing specifications, illustrations, installations, prices and how to figure electric space heating.

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Commercial Controls Corporation
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We are interested in ☐ Home ☐ Industrial ☐ Farm

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SWITCHBOARD & DEVICES CO.
CANTON, OHIO
A subsidiary of
The Union Metal Manufacturing Company

whatever the joint needs

IN ONE PACKAGE FROM PLM

● Why waste time worrying with many materials, from many sources, for splices and terminations? PLM Unit Package Kits simplify planning and estimating...provide *complete* materials in *one* package for correctly designed splice or termination. Supplied for rubber, synthetic, VC or paper-insulated cable – metallic and non-metallic sheathed – for ratings through 23 kv. Write for catalog.

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Splicing Kits

Complete materials in one package for splicing

- Cable in conduit to armored cable
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- Lead-covered cable to armored cable
- Single conductor cables to armored cable – or any combination of above.

PLM *Products, Inc.*
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WIRE AND CABLE FITTINGS AND ACCESSORIES
Armored Cable Terminators • Splicing and Terminating Kits • Conduit Ventilators

POWER BRIEFS

● Atomic power generator of 250,000 kw is planned by Consolidated Edison Co of New York, Inc. Construction at Buchanan, N. Y., will begin as soon as a license to proceed is received from Atomic Energy Commission. In addition, two steam generating units of 335,000 kw each are planned for 1956 construction: One is slated for the Astoria Station, Queens; the other for Arthur Kill Station, Staten Island.

● Pacific Power & Light Co, Portland General Electric Co, and California Oregon Power Co are negotiating with Grant County, Wash., Public Utility District for 31% of Priest Rapids and Wanapum hydroelectric power. PP&L and PGE want 140,000 kw each and COP is asking for 65,000 kw for distribution to Oregon customers. Estimated cost of the project, first Pacific Northwest partnership development in Eisenhower's Administration, is $349 million. Construction will begin July 1956.

● A record-breaking $73.3-million construction budget has been set by South Carolina Electric & Gas Co for the next three years, most of it allocated for electric facilities. The 137,000-kw, $19-million Saluda Dam steam plant in the Charleston Division is a major item. SCE&G will spend $14.5 million in 1956, $36.2 million next year, and $22.6 million in 1958.

● Steam from underground volcanic country near Geyserville, Calif., may produce electricity for Thermal Power Co if present steam well drilling proves successful. An oilfield rig reached a depth of 612 ft in Sonoma County before steam pressure estimated at 1,200 lb/sq in. halted operation. The steam well, first of its kind in recent years, is patterned after Italian prototypes.

● Construction starts April 1 on Appalachian Electric Power Co's 450,000-kw Clinch River plant in western Virginia. The company, a subsidiary of American Gas & Electric Co, will place the two-unit, $55-million plant in service in 1958.

● New construction which will double Southern Co's present capacity of 3,535,000 kw within nine years was described recently by J. M. Barry,

chairman of the executive committee. Expenditures for the system would be about $100 million a year to start and might eventually reach $175 million a year, he told New York Society of Security Analysts. Alabama Power Co, Georgia Power Co, Mississippi Power Co, and Gulf Power Co are the firm's subsidiaries.

● Ohio Power Co, subsidiary of American Gas & Electric Corp, has acquired a site near Ironton, Ohio, where it will construct a steam generating plant with an ultimate capacity of 1-million kw.

● Houston Lighting & Power Co will start work on a 165,000-kw unit for a new steam generating plant southeast of the Richmond-Rosenberg area in April. Scheduled completion date in 1958 will coincide with operation of a second 165,000-kw unit at Sam Bertron plant, bringing HL&P system capacity to almost 1,750,000 kw.

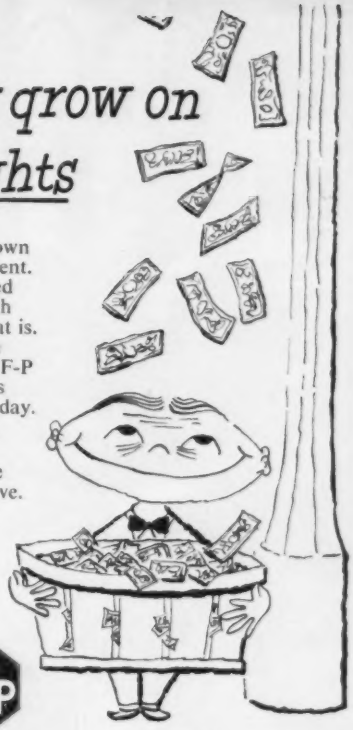
● Work is set to begin this month on Public Service Co of Indiana's steam generating plant at New Albany, Ind. The $47-million project will include two 150,000-kw units and will be the fifth largest plant on the Ohio River near Louisville, Ky., where Louisville Gas & Electric Co has four steam stations and one hydro plant.

● New England Electric System has placed an order for a General Electric Co generating unit of 125,000-kw capability to be housed in Salem Harbor (Mass.) Station. The unit will go on the line by 1958 upping system's generating capacity to 1.4-million kw, nearly double that of 1945.

● Construction will begin early in 1957 on a $13-million unit for Council Bluff Power Station of Iowa Power & Light Co bringing the plant's capacity to 119,000 kw. The unit, Iowa's largest, will be completed in December 1958. Black & Veatch Co of Kansas City, Mo., is performing design engineering work.

● Major construction planned by Georgia Power Co in its 1956 expansion program includes work on two 125,000-kw steam generating units at Plant Yates near Newnan, for which $13.5 million has been allocated. Ultimate plant capacity will be 550,000 kw in 1958, upon completion of the fourth and fifth units.

making money grow on .....streetlights



Although no one as yet has grown money on trees, *streetlights* are different. At least when some economy-minded utility engineer has equipped them with Fisher-Pierce photoelectric controls, that is. On low *first* cost, on reduced *installation* cost, and minimum *maintenance* cost, F-P units are producing substantial savings for the hundreds of utilities using them today.

The F-P *Series 64400* control is a good example. Low initial cost and infrequent repair make it practical to use *one 64400 per lamp*, as many utilities have.

Add to this economy the *basic* advantages of F-P photoelectric lighting controls: light *when* it is needed, independent of time, season or weather; *dependable* operation, a result of Fisher-Pierce's ten years of experience in this field. Facts and figures for the asking.

FP

THE FISHER-PIERCE COMPANY, INC.
82 Pearl Street, So. Braintree, Boston 85, Mass.

EXPORT: Philips Export Corp., 100 E. 42nd Street, New York 17, N. Y.
In Canada: Northern Electric Co., Ltd.

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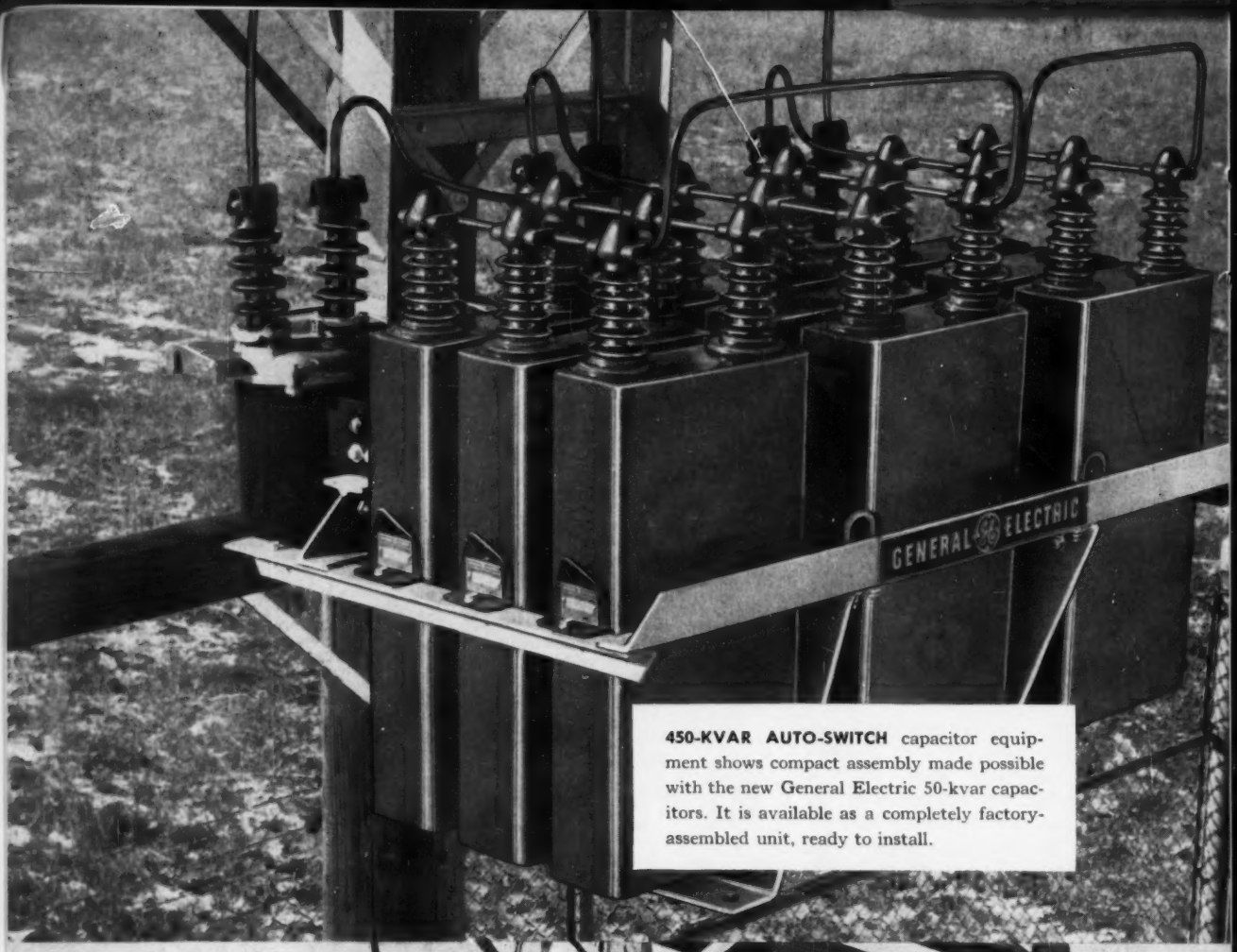
Send the coupon today for your copy of our new catalog showing the wide range of application as well as the many exclusive features that make the *Acker All-Purpose Digger* the most versatile and useful you can buy!

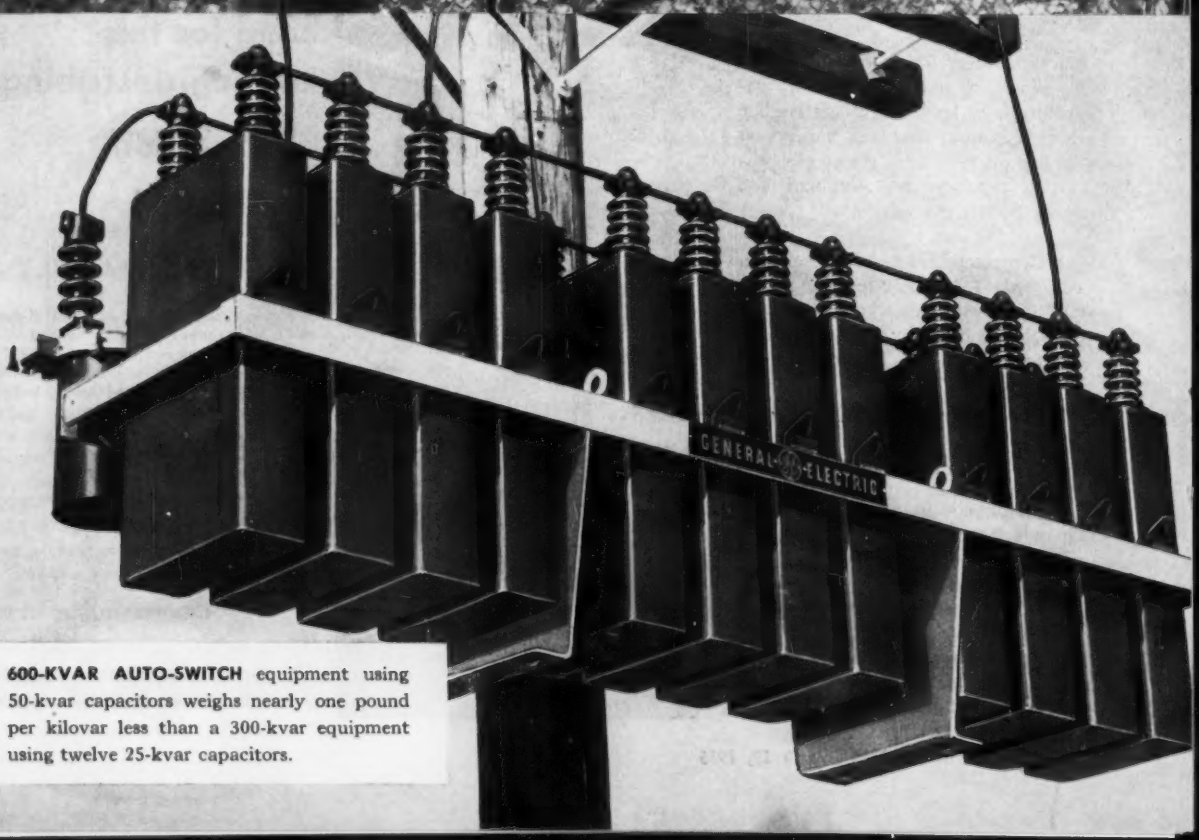
TWO MODELS TO CHOOSE FROM — Jeep mounting with compact, power take-off or skid-mounted with self contained power plant for truck mounting.

ACKER DRILL CO., Inc.
725 W. Lackawanna Avenue, Scranton, Penna.
Please send me free copy of Bulletin 40. EW.

Name_____ Title_____
Firm_____
Street_____
City_____ State_____



450-KVAR AUTO-SWITCH capacitor equipment shows compact assembly made possible with the new General Electric 50-kvar capacitors. It is available as a completely factory-assembled unit, ready to install.



600-KVAR AUTO-SWITCH equipment using 50-kvar capacitors weighs nearly one pound per kilovar less than a 300-kvar equipment using twelve 25-kvar capacitors.

New G-E 50-kvar Capacitors Double Auto-switch Capacity

Higher rated units mean lower costs, less weight and bending moment, lower switching cost, per installed kilovar

General Electric's new 50-kvar capacitors, designed so that they have the same mounting dimensions as existing 25-kvar units, now enable you to put MORE kilovars on the pole with sizeable savings in space, weight, and cost per kvar.

More compact equipments made possible with these new capacitors can give you double the kilovars formerly available in 25-kvar capacitor equipments with little or no increase in rack dimensions. Racks are factory assembled, and are available in ratings from 2400 to 13,800 volts.

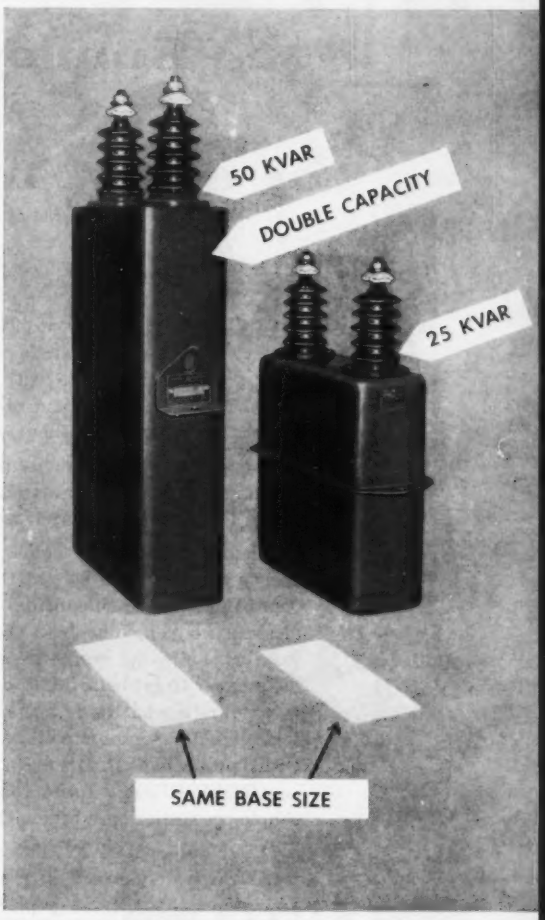
Reduced weight per kvar is made possible because one 50-kvar capacitor weighs approximately 15% less than two 25-kvar units. This results in even further weight savings in complete auto-switch equipments. For example, a single row auto-switch made up of twelve 25-kvar units weighs about 1110 lbs or 3.7 lbs per installed kvar. Use of 50-kvar units in the same arrangement gives you a pole-mounted equipment of only 2.8 lbs per installed kvar.

This 25% savings in weight per installed kvar is doubly significant. It means that bending moment on poles, an important consideration today, may be notably reduced per installed kvar by the use of 50-kvar capacitors in pole-mounted equipments.

Low kilovar costs also result from the use of 50-kvar capacitors. One 50-kvar unit costs 10% less than two 25-kvar capacitors. And, in switched equipments, switching cost can be reduced as much as 13% since a 600-kvar auto-switch requires no more switches than a 300-kvar equipment.

New features, too, have been built into the 50-kvar capacitor auto-switch designs. New neoprene switch terminal boots require no taping. Self grounding washer-head mounting screws eliminate loose parts, and provide permanent unit case grounding.

Orders are now being accepted for the new, higher rated auto-switches. The new bulletin, GEA-6485, contains full information on the 50-kvar capacitor equipments. Just contact your G-E Apparatus Sales Representative, or write to the General Electric Company, Section 441-34, Schenectady 5, New York.



NEW G-E 50-KVAR CAPACITOR has been designed so that it will be interchangeable with existing 25-kvar units having standard NEMA mounting dimensions. Doubled capacity is achieved with an increase of only eleven inches in height over the 25-kvar G-E unit. It is available in both 5- and 8.7-kv classes.

Progress Is Our Most Important Product

GENERAL ELECTRIC

To the Employee Relations Director of every American company

LET'S FACE IT . . . the threat of war and the atom bomb has become a real part of our life—and will be with us for years. Fires, tornadoes and other disasters, too, may strike without warning.

The very lives of your employees are at stake. Yours is a grave responsibility. Consider what may happen.

When the emergency comes, everybody's going to need help at the same time. It may be hours before outside aid reaches you. The best chance of survival for your workers—and the fastest way to get back into production—is to know what to do and be ready to do it. To be unprepared is to gamble with human lives. Disaster may happen TOMORROW. Insist that these simple precautions are taken TODAY:

☐ **Call your local** Civil Defense Director. He'll help you set up a plan for your offices and plant—a plan that's safer, because it's entirely integrated with community Civil Defense action.

☐ **Check contents** and locations of first-aid kits. Be sure they're adequate and up to date. Here again, your CD Director can help—with advice on supplies needed for injuries due to blast, radiation, etc.

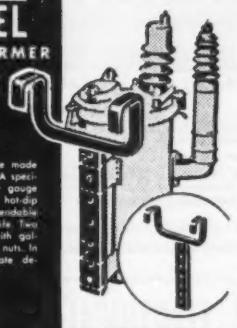
☐ **Encourage personnel** to attend Red Cross First Aid Training Courses.

☐ **Encourage your staff** and your community to have their homes prepared. Run ads in your plant paper, in local newspapers, over TV and radio, on bulletin boards. Your CD Director can show you ads that you can sponsor locally. Set the standard of preparedness in your plant city. There's no better way of building prestige and good employee relations—and no greater way of helping America.

Act now . . . check off these four simple points . . . before it's too late.

THIEL
TRANSFORMER
HANGERS

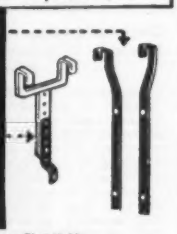
THIEL Hangers are made according to NEMA specifications — heavy gauge steel construction, hot-dip galvanized for dependable service and long life. Two styles complete with galvanized bolts and nuts. In stock for immediate delivery.



MODEL	1-PHASE	3-PHASE	WEIGHT
T-1	3-15 KVA	9 KVA	16¼ lbs.
T-2	25—37—50 KVA	15-45 KVA	37¼ lbs.

C-TYPE HANGERS:
Two sizes - for 75-100 KVA 1-phase and 75-112½ KVA 3-phase transformers.

HANGER KICKERS:
In sizes to fit T-type Hangers — in four and five mounting positions.



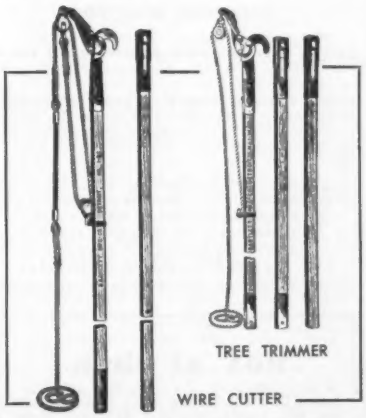
Electrical Fasteners That Hold . . .

THIEL TOOL & ENGINEERING CO. INC.
1417 No. Market St. • St. Louis 6, Mo.

IN CASE OF EMERGENCY, Use BARTLETT No. 1-BC Wire Cutter and No. 1-WJ Jointed Tree Trimmer

The No. 1-BC will readily cut 110 and 220 R. C. wire and is easily operated from the ground. It can also be used safely for cutting hot 4800 volt primary and service wire when hanging down close to the ground. Made in two six-foot sections easily joined together to make a twelve-foot pole.

The No. 1-WJ Tree Trimmer is made in four-foot sections and can be easily transported in a small car. This tool will sever a 1¼-inch branch with ease.



BARTLETT MANUFACTURING COMPANY
3048 E. Grand Boulevard Detroit 2, Michigan

Rates for Georgia Power Ruled 'Just, Reasonable'

Wholesale electric rates charged to Georgia Power Co by South Carolina Generating Co have been ruled "just and reasonable" by Emery J. Woodall, Federal Power Commission examiner.

His decision, the result of a five-month investigation, stated that although capacity charges paid by Georgia Power are higher than two other customers of the generating company, the utility could not produce electricity for less than it is being charged.

South Carolina Electric & Gas Co, parent firm of the generating company, and E. I. DuPont De Nemours & Co, agents for the Atomic Energy Commission's Savannah River project, are the other customers. Although energy rates are the same for all three customers, capacity charges vary.

Customers holding contracts for the output of South Carolina Generating Co's Urquhart Plant near Beech Island, S. C., and respective capacity charges are Georgia Power Co, 75,000 kw at $22.50 per kw; Dupont, 30,000 kw at $19.50; and South Carolina Electric & Gas Co, 45,000 kw at $15.30 per kw.

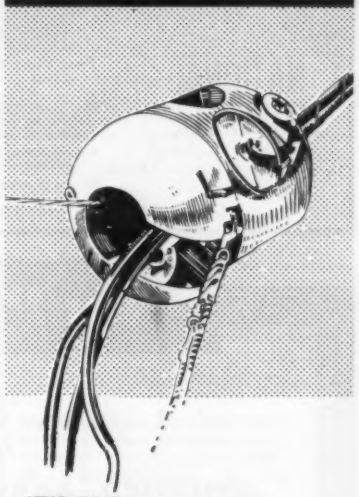
Rubber, Plastics Parley Set by AIEE April 9-10

A two-day conference on electrical engineering problems in the rubber and plastics industries will be held April 9 and 10 at Akron, Ohio's Mayflower Hotel. The American Institute of Electrical Engineers is sponsor of the parley through its general industry applications subcommittee on rubber and plastics industries.

W. E. Chope, president of Industrial Nucleonics Corp, Columbus, Ohio, and Eta Kappa Nu's outstanding young electrical engineer of 1955 will give the keynote address. Banquet speaker will be W. S. Wolfe, factory manager of Domestic Operations for the Goodyear Tire & Rubber Co, Akron, Ohio.

Symposiums will be held during the conference on controls, safety, personnel training, insulation, standardization, regulators, and dielectric heating.

THREE TO ONE



IT'S THE
NEALE MODEL "K"
Only the
Model "K" Spinner
PLACES & SPINS
THREE SINGLE CABLES
Into
ONE COMPACT UNIT

ALSO SPINS SINGLE CABLE PERFECTLY

WRITE FOR LITERATURE AND PRICES

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TOPEKA KANSAS
Phone 2-7234

OVERSEAS SALES:
Ericsson Telephone Sales Corp. of New York
Automatic Electric of Canada
Pirelli of Great Britain

EMPLOYMENT OPPORTUNITIES

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

Positions Vacant
Positions Wanted
Part Time Work

Civil Service Opportunities
Selling Opportunities Wanted
Selling Opportunities Offered

Employment Agencies
Employment Services
Labor Bureaus

DISPLAYED —RATES— **UNDISPLAYED**

The advertising rate is $19.15 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

$1.50 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

Box Numbers—counts as 1 line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Not subject to Agency Commission.

Send NEW ADS to ELECTRICAL WORLD, 330 W. 42nd St., N. Y. 36, N. Y., for April 2nd issue closing March 23rd

du Pont...

A Long Range Career Opportunity for a

UTILITIES CONTRACT ENGINEER

The Engineering Service Division of du Pont's Engineering Department has an immediate opening for a graduate Mechanical or Electrical Engineer with 8 to 10 years' experience with one or more gas and electric utility companies in rate design, in drawing up and negotiating utility contracts, and in utility industrial sales and development work. Successful applicant will handle negotiations with public utilities for purchase of electricity, steam, water, gas, and telephone service, and will assist in plant site evaluations.

Please send complete resume, including details of education and experience, to:

Mr. J. C. Costello, Jr.
Engineering Department

E. I. du Pont de Nemours & Co., Inc.
Wilmington 98, Delaware

ELECTRICAL ENGINEERS

SENIOR—ASSISTANT AND JUNIOR ENGINEERS— COLLEGE GRADUATES

Electrical Design — Public Utility Power Plants — Distribution and Transmission Systems.

ELECTRICAL PLANNING ENGINEERS — SENIOR & ASSISTANT — Strong background and experience in power system planning and economic studies.

ELECTRIC POWER STATION RELAY & APPLICATION ENGINEER — At least 5 years experience — preparation design and specifications of relay protection for power systems. Also for short circuit, power flow and stability studies. Knowledge of d-c and a-c network analyzer, operation and symmetrical components helpful.

ELECTRICAL ENGINEERS — SENIOR — At least 10 years design experience in steam or hydro plants and transmission substations. Knowledge of operation and construction desirable.

ELECTRICAL ENGINEERS — JUNIOR — Minimum 2 years experience — for electrical design of power stations and substations. Also for general analytical work on relay, short circuit calculations and economic studies.

ELECTRICAL DISTRIBUTION ENGINEER — 8 years general experience utility distribution work and studies.

Location New York — with established service organization for large group of utilities. Reply stating age, education, experience, personal particulars and salary expected.

AMERICAN & FOREIGN POWER COMPANY INC AND SUBSIDIARIES
2 Rector Street, New York 6, N. Y.
21st Floor DI 4-4400 Ext 8494

Job Open For RELAY ENGINEER

with at least four years' experience. Some field experience desirable.

Apply in writing, giving age, education, experience and salary desired, to:

Transmission Dept.
SOUTHWESTERN GAS and ELECTRIC COMPANY
Shreveport, La.

CIVIL SERVICE EXAMINATIONS

Senior Electrical Draftsmen—$447 to $495 per mo.
Electrical Draftsmen —$365 to $413 per mo.
Liberal vacation and pension plans. For application forms and detailed information as to eligibility, call or write:

Chicago Park District
Dept. of Personnel and Civil Service
425 East 14th Blvd., Chicago 5, Ill.
HA 7-5252, Ext. 465

POSITIONS VACANT

A well known Mid-Western Concern offers excellent opportunity for engineer capable of completely designing incandescent, mercury, and fluorescent street lighting luminaries. Your reply with complete qualifications will be held confidential. P-9436, Electrical World.

Engineering Faculty Member, to head newly authorized Electrical Engineering Department. Candidate should have M.S. or Ph.D degree, with teaching and professional experience. Position to be filled prior to September, 1956. Salary open. Write to R. E. Gibbs, Dean, College of Engineering, Bradley University, Peoria 5, Ill.

EMPLOYMENT SERVICES

Salaried Personnel. $5,000-$30,000. This Confidential service, established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, P. O. Box 674, Manchester, Vermont.

POSITIONS WANTED

System Operator—load dispatcher, 20 years experience. PW-9351, Electrical World.

Power Engineer—Thirteen years experience in plants up to 100,000 K.W. capacity, Technical education, 29 years of age. Seeks responsible position. PW-9387, Electrical World.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1125 W. 6th St. (17)

Don't forget the

BOX NUMBER

When answering the classified advertisements in this magazine don't forget to put the box number on your envelope. It is our only means of identifying the advertisement you are answering.

CLASSIFIED **SEARCHLIGHT SECTION** ADVERTISING

BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

UNDISPLAYED RATE:

$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.50 a line an insertion.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:

The advertising rate is $14.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

SEND NEW ADVERTISEMENTS TO: 330 West 42 St., N. Y., for April 2nd issue closing March 23rd

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FOR SALE

Eight Condit Type "08" CIRCUIT BREAKERS

7500 Volt, 400 Amps., 50,000 KVA Rating on a CO-2 min-CO Duty Cycle. Manufactured 1936. In Good Operating Condition. If interested contact N. C. Stirewalt, V.P., Central Illinois Public Service Company, Springfield, Illinois.

U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-4657) will be received at Denver, Colorado, until April 17, 1956, for furnishing two 2,500-volt, metal-enclosed, indoor-type, motor control equipment assemblies for East Bountiful and South Davis Pumping Plants, Weber Basin Project, Utah. Delivery is desired within 240 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

OFFICIAL PROPOSALS

Bids: April 3, 1956

Power Authority of the State of New York

ST. LAWRENCE POWER PROJECT
ADVERTISEMENT FOR PROPOSALS
FOR THE
REHABILITATION OF THE
MASSENA-TAYLORVILLE
TRANSMISSION LINE, NEW YORK
SPECIFICATION NO. PA-5-14033
ST. LAWRENCE CONTRACT NO. M3

NOTICE TO CONTRACTORS: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the Rehabilitation of the Massena-Taylorville Transmission Line, New York, in the following ways:

(1) If Brought in person on the day of receiving bids, until 10:30 A. M. Eastern Standard Time on the 3rd day of April 1956, 270 Broadway, Hearing Room C on the 6th floor, New York, New York.

(2) If mailed in, until 10:15 A. M. Eastern Standard Time on the 3rd day of April 1956, at the Authority's office, 270 Broadway, Room 1300, New York 7, New York.

The proposal will be publicly opened and read aloud at the time and at the address given in (1) above.

Bids will be entertained for furnishing the equipment and services and performing the work in accordance with the bidding schedule. Completion of the work will be required on or before July 1, 1957.

Plans, specifications and Proposal Forms for the work will be on file in the Authority's office and in the offices of the Engineer, Uhl, Hall and Rich, 230 Congress Street, Boston 10, Massachusetts, may be inspected by prospective bidders during office hours, and may be obtained from the Power Authority of the State of New York, 270 Broadway, Room 1300, New York 7, New York, upon application and prepayment of a fee of ten ($10.00) dollars per initial set of contract documents and five ($5.00) dollars per set for additional sets, no part of which will be refunded. Two sets must be returned with each bid.

Bids must be made in duplicate in accordance with instructions contained in the Information for Bidders. Guarantee will be required with each bid in an amount not less than 10 percent of the gross sum bid.

The right is reserved to reject any and all bids.

W. S. CHAPIN
GENERAL MANAGER

ELECTRICAL WIRE AND CABLE

—YOUR BEST SOURCE—

- for every industrial and power application
- Odd lengths—long and short—reasonably priced

One of the Largest Stocks in the Midwest

Let us quote on requirements—
send your inquiries
We'll also buy your Surplus

Branch Offices:

Houston— Walnut 3-4580
Los Angeles— ANgeles 3-5148

FOR YOUR TEMPORARY NEEDS TRY OUR SURPLUS DIVISION

UNIVERSAL Wire and Cable Co.

2664M N. Clybourn Ave., Chicago 14, Ill.
EAstgate 7-4777 Code: UNIWIRE

LARGE POWER EQUIPMENT

Prompt Stock Shipment

RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?

BELYEA COMPANY INC.

51 Howell St. Jersey City, N. J.

"SEARCHLIGHT"

IS

Opportunity Advertising

—to help you get what you want
—to help you sell what you no longer need.

Take Advantage Of It

For Every Business Want

"THINK SEARCHLIGHT FIRST"

TRANSFORMERS

FOR SALE

3—1000 KVA Mol. 11500-2400/4160Y
3— 500 KVA W-H 33000-2300/2400
3— 500 KVA G-E 22000-2300/4000Y
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300	Ideal	SMM	.8	257
300	G. E.	ATI	.8	1200
255	El. Ma.		1.0	360
250	G. E.	ATI	.8	900
250	Al-Ch.	SYN	1.0	1200
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200	Fair.-Mor.	TJC-285	.8	720
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150	Fair-Mor.	TJC-285	.8	720

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READERS FORUM

Coover Gets Properly Located

To the Editor:

In the Feb. 6 issue the announcement of the nomination of Mervin S. Coover as president of the American Institute of Electrical Engineers for 1956-57 states that he is "head of the Electrical Engineering Department, Iowa State University".

Please be advised that he is the associate dean of engineering and professor of electrical engineering at Iowa State College, Ames, Iowa.

The State University of Iowa is located at Iowa City.

F. M. Henderson
Transmission Supt

Corn Belt Power Cooperative
Humboldt, Iowa

AGA Engineer Protests Article

To the Editor:

This letter is in protest to certain incorrect portions of the article on Evelyn's Seafood Restaurant entitled, "What Happens When a Restaurant Switches to Electric Cooking?" This article appeared in the Jan. 23 issue, p 221.

The statement is made in the title and in the text that when this restaurant was operating on gas, it required 40 tons of refrigeration for air conditioning and that after the switch to electricity it required only 17 tons. I am summarizing the facts of the matter to show you why I am writing this protest asking that a correcting statement be made.

In the period between 1950 and 1952, when the restaurant was using gas, 10 tons of air conditioning equipment were installed and in use. In 1953 the restaurant switched to electric operation. In 1954 4½ tons more refrigeration were added. In 1955 3½ tons more were added so that they now have 18 tons of air conditioning equipment. Estimates, based on last year's operating temperatures, show that at least 10 tons of additional refrigeration should be added to make the job completely satisfactory.

It is important to note in this situation that the Btu released by the new electric equipment is substantially greater than that available from the former gas equipment. This not only furnishes increased capacity and improves the operating speed of the kitchen equipment, but it also raises temperatures. The immediate result of installing electrical equipment appears to have resulted in complaints from the cooks that the canopy and exhaust system, formerly satisfactory, were no longer able to handle the load. Therefore, two additional window fans were added but complaints of excessive temperature were still reported last summer.

The records available to us indicate that at no time were recommendations made to the restaurant that 40 tons of refrigeration be used with gas. I am confident that you will easily verify these matters, and I look forward to your correction.

C. George Segeler
Engineer of Utilization

American Gas Association
420 Lexington Ave
New York 17, N. Y.

Capability Definition Poses Questions

To the Editor:

Your editorial in the Feb. 13 issue, entitled, "Let's Define Capability," called attention to a matter which deserves consideration. The editorial dealt only with steam units and did not refer to hydro plants which present an entirely different set of problems because of variations in stream flow.

We do not believe that it is possible in many instances to determine capabilities by units because there are often limiting factors in the station outside the generating units. The station capability may be limited by boiler capacity, by the supply of condensing water or its temperature, by the capacity of pulverizing equipment, or by various other factors aside from the units themselves.

For the reasons enumerated we have felt that capability should be expressed in terms of station kilowatts only, but even here there are further questions to be answered. Should the capability of the station be given as gross or net; that is, should it include station use or should station use be deducted. Another question that arises is how should the capacity of a house generator be treated. Is it part of station capacity, or is it merely a station auxiliary?

In some cases the one-hour or 90-minute capability may be quite different from the continuous capability. Such could be the case in a steam station which is short on pulverizing equipment and is true of most hydro plants which have a pond capable of manipulation. A hydro plant of this kind is capable of supplying its full overload capacity over the daily peak load but could not carry the base load. For this reason the capability of hydro plants in a system supplied primarily by hydro would be less than the capability of the same hydro plants in a system in which most of the capacity is supplied by steam plants.

H. W. Meyer
Statistical Engineer

Northern States Power Co
Minneapolis 2, Minn.

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MEETINGS CALENDAR

MARCH

ATOMIC INDUSTRIAL FORUM, INC—Hotel Plaza, New York City, March 19-20.

INSTITUTE OF RADIO ENGINEERS—Annual National Convention, Waldorf-Astoria Hotel, New York, March 19-22.

AMERICAN POWER CONFERENCE—18th Annual Meeting, Sherman Hotel, Chicago, Ill., March 21-23.

OKLAHOMA UTILITIES ASSOCIATION—Annual Convention, Biltmore Hotel, Oklahoma City, Okla., March 22-23.

PACIFIC COAST ELECTRICAL ASSOCIATION—Engineering & Operating Section, Palace Sheraton Hotel, San Francisco, March 22-23.

EDISON ELECTRIC INSTITUTE—Street Lighting Committee, Minneapolis, March 23-24; 22nd Annual Sales Conference, Edgewater Beach Hotel, Chicago, March 26-29.

TENNESSEE VALLEY PUBLIC POWER ASSOCIATION—10th Annual Meeting, Farragut Hotel, Knoxville, Tenn., March 30-31.

APRIL

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—South West District Meeting, Baker Hotel, Dallas, Tex., April 2-4; Special Technical Conference & Exhibit on Magnetic Amplifiers, Hotel Syracuse, Syracuse, N. Y., April 5-6; 8th Conference on Electrical Engineering in the Rubber and Plastics Industries, Mayflower Hotel, Akron, Ohio, April 9-10; Great Lakes District, Fort Wayne, Ind., April 16-18; Technical Conference, Bradford Hotel, Boston, Mass., April 26-27.

INDIANA ELECTRIC ASSOCIATION—16th Annual Young Men's Utility Conference, Hotel Van Orman, Fort Wayne, Ind., April 4-5.

ELECTRICAL MAINTENANCE ENGINEERS ASSOCIATION—8th National Biennial Electric Industry Show, Shrine Exposition Hall, Los Angeles, Calif., April 5-7.

MARYLAND UTILITIES ASSOCIATION—Annual Business Conference, Lord Baltimore Hotel, Baltimore, Md., April 6.

MIDWEST RESEARCH INSTITUTE—Symposium for Management on Applications of Analog Computers, Hotel Phillips, Kansas City, Mo., April 10-11.

POINT OF PURCHASE ADVERTISING INSTITUTE—10th Annual Symposium & Exhibit, Hotel Sheraton Astor, N. Y., April 10-12.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Engineering & Operation Section, Hotel Vancouver, Vancouver, B. C., April 11-13.

NORTHWEST PUBLIC POWER ASSOCIATION, INC—Annual Membership Meeting, Ridpath Hotel, Spokane, Washington, April 11-13.

SOUTHEASTERN ELECTRIC EXCHANGE—Engineering & Operation Section, Bon Air Hotel, Augusta, Ga., April 12-13.

* **EDISON ELECTRIC INSTITUTE**—Advisory and Executive Committees, Hotel Commodore, New York, N. Y., April 16; National Conference of Electric & Gas Utility Accountants, sponsored jointly with AGA, Hotel Commodore, April 16-18; Industrial Relations Committee, EEI Headquarters, N. Y. C., April 19; Engineering Committees, Edgewater Beach Hotel, Chicago, April 30-May 2.

GREATER NEW YORK SAFETY COUNCIL—26th Annual Safety Convention & Exposition, Hotel Statler, New York City, April 16-20.

ATOMIC INDUSTRIAL FORUM, INC—Atomic Energy Conference, Atlanta, Ga., & Oak Ridge, Tenn., April 17-19.

PACIFIC COAST ELECTRICAL ASSOCIATION—Administrative Services Section Meeting, Huntington-Sheraton Hotel, Pasadena, Calif., April 18-20.

MISSOURI VALLEY ELECTRIC ASSOCIATION—Engineering Conference, Hotel President, Kansas City, Mo., April 18-20.

PENNSYLVANIA ELECTRIC ASSOCIATION—Meter Committee, Roosevelt Hotel, Pittsburgh, Pa., April 19-20.

PROTECTIVE RELAY ENGINEERS—Ninth Annual Conference, Department of Electrical Engineering, Agricultural and Mechanical College of Texas, College Station, April 23-25.

* **ROCKY MOUNTAIN ELECTRICAL LEAGUE**—Spring Meeting, Shirley-Savoy Hotel, Denver, Colo., April 29-May 1.

MAY

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—North Eastern District Meeting, Rochester, New York, May 2-4.

EDISON ELECTRIC INSTITUTE—Accident Prevention Committee, Coronado Hotel, St. Louis, Mo., May 2-4; Purchasing & Stores Committee, Sheraton Plaza Hotel, Boston, Mass., May 7-9; Commercial Electric Cooking Conference, Sheraton Hotel, Chicago, Ill., May 8; Transportation Committee Meeting, jointly with AGA, Congress Hotel, Chicago, Ill., May 8-11; Industrial Relations Committee, Willis E. Hughes Memorial, Rochester, N. Y., May 17; Orientation Meeting jointly with AGA, Headquarters, New York, N. Y., May 21.

NATIONAL FARM ELECTRIFICATION CONFERENCE—LaSalle Hotel, Chicago, Ill., May 3-4.

* **PENNSYLVANIA ELECTRIC ASSOCIATION**—Hydraulic Power Committee, Hotel Warwick, Philadelphia, Pa., May 3-4; Relay and Electrical Equipment Committees, Hotel Roosevelt, Pittsburgh, May 17-18.

* **NATIONAL ASSOCIATION OF RAILROAD AND UTILITIES COMMISSIONERS**—Executive Committee, Leamington Hotel, Minneapolis, Minn., May 4.

AIR-CONDITIONING & REFRIGERATION INSTITUTE—Annual Meeting, The Homestead, Hot Springs, Va., May 7-9.

AMERICAN WELDING SOCIETY—Fourth Welding Show, Memorial Auditorium, Buffalo, N. Y., May 9-11.

NORTHWEST PUBLIC POWER ASSOCIATION, INC—Engineering & Operations Section, Cascadian Hotel, Wenatchee, Washington, May 10-11.

* **PUBLIC UTILITIES ADVERTISING ASSOCIATION**—Annual Convention, Philadelphia, Pa., May 10-11.

PACIFIC COAST ELECTRICAL ASSOCIATION—Annual Convention, Las Vegas, Nevada, May 14-16.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Design Engineers—Design Engineering Conference, Convention Hall, Philadelphia, Pa., May 14-17.

ILLINOIS INSTITUTE OF TECHNOLOGY—Industrial Nuclear Technology Conference, Museum of Science & Industry, Chicago, Ill., May 15-16.

* **GREAT LAKES POWER CLUB**—Wagon Wheel Hotel, Rockton, Ill., May 17-18.

NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS—30th Engineering Industries Exposition with Annual Convention, Statler Hotel, New York City, May 17-19.

INDUSTRIAL HEATING EQUIPMENT ASSOCIATION, INC—Spring Meeting, The Homestead, Hot Springs, Va., May 20-23.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Business Developments Section, Benjamin Franklin Hotel, Seattle, Wash., May 21-23.

AMERICAN MANAGEMENT ASSOCIATION—General Management Conference, Hotel Roosevelt, New York City, May 23-25.

* **NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS**—Annual Meeting, Ambassador Hotel, Atlantic City, N. J., May 23-26.

CIGRE—16th Annual International Conference, Paris, France, May 30-June 9.

JUNE

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS—52nd Annual Meeting, Sheraton-Gibson Hotel, Cincinnati, Ohio, June 4-6.

EDISON ELECTRIC INSTITUTE—24th Annual Convention, Traymore Hotel, Atlantic City, June 4-6.

* **AMERICAN SOCIETY OF CIVIL ENGINEERS**—National Spring Meeting, Knoxville, Tenn., June 4-8.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Summer and Pacific General Meetings, San Francisco, California, June 25-29.

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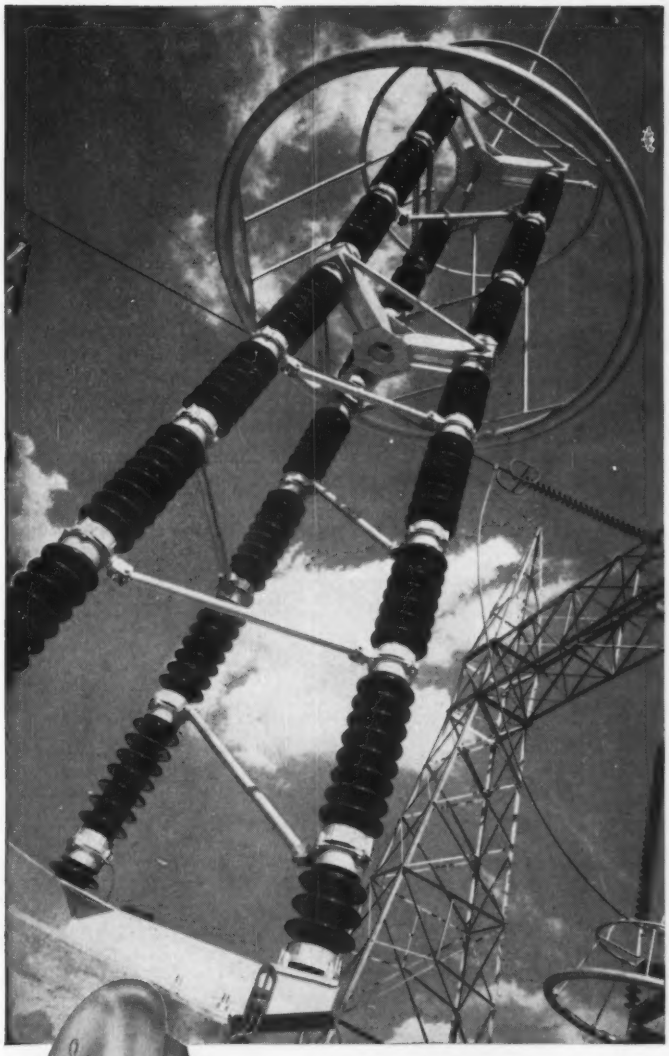
* Additions this week.



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Study Criticizes Annual Reports

Finds emphasis is on use of gaudy charts, illustrations, and type rather than on efforts to give stockholders all the facts

For those companies which have not yet completed their 1955 annual reports, some recently issued critical comments on this important channel of communications should be of interest. The comments are contained in a special study on stockholders relations by the American Institute of Management.

The 119-p monograph, entitled "Service to Stockowners of the Corporation," finds that management makes a mistake when it looks upon the annual report as an instrument for gaining public favor, rather than as a means of informing shareowners—the true proprietors—about how well or how poorly their company is conducted. The annual report should tell stockholders about the success or failure of plans actually implemented, the effects of past policy upon present conditions, and the outlook for the year ahead, it says.

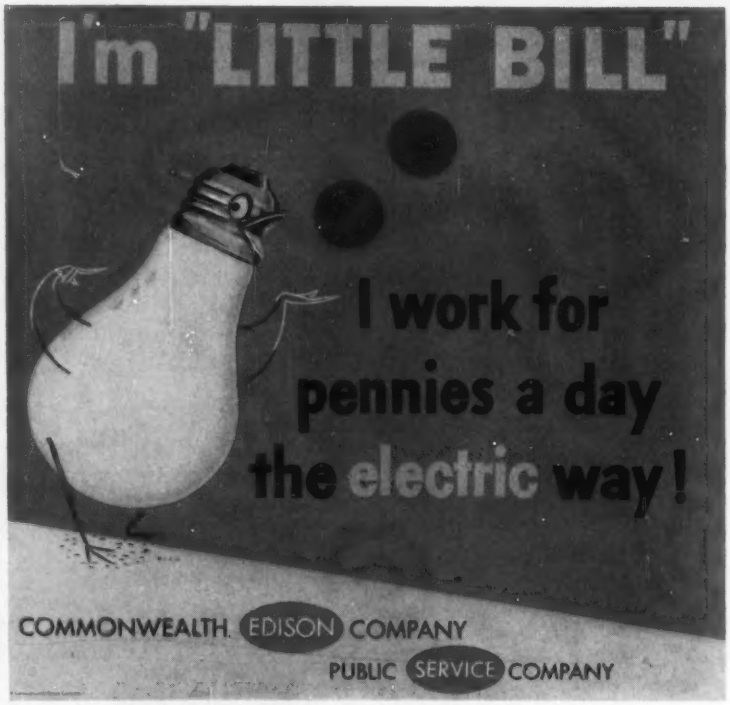
"The influence of public relations' concepts on the average annual report has been unfortunate. Lavish use of meaningless charts, costly and inappropriately gaudy printing, and a general tendency to view the annual report solely as a piece of sales literature have mitigated against its performing its function of conveying useful information. The general emphasis seems to be upon predigesting of the favorable aspects of corporate developments and the glossing over of difficulties." This tendency is so marked, the study finds, that few companies stand out as exceptions.

Relegating too much financial information to footnotes on the financial statements is a major flaw in many annual reports, says the study. "Few stockholders are sufficiently versed in the intricacies of corporate accounting to be able to interpret the balance sheets and profit-and-loss statements with true insight into what they imply," the study advises. "Even fewer take the trouble to read the notes with care, or can interpret them properly if they do. Therefore, the temptation is strong to make 'full revelation' of matters of importance only in such notes." This meets the technical requirements without forcing management to record why it has followed the policies which brought about the results.

The AIM study also makes these points:

- "Management should maintain the closest possible contact with its stockholders." (The study cites the example of General Public Utilities Corp which makes sure that all large stockholders are called upon once a year by a top officer).
- "Annual reports should be written to be read and understood. Gaudy illustrations will not assure this, although some advertising-conscious firms appear to think so."
- "In general, doubt, misinformation, and lack of knowledge and identification with the company are the conditions which must be eliminated."

Copies of the study are available from AIM, 125 East 35th St., New York 16, N. Y., at $12 each.



Ad Character Popular in Chicago

Commonwealth Edison Co's "Little Bill" advertising character celebrated his first birthday last month, looking back upon a year of rapid public acceptance and popularity growth.

Little Bill attracted so many comments when he was first introduced that Commonwealth made an impact study to see how he was accepted generally. The survey was of public reaction to a single advertisement in the Chicago Tribune. It showed that only one other ad (featuring a hair preparation) had a higher impact rating than Little Bill. Furthermore, most of the people who remembered the ad were able to give a clear account of the economy story Little Bill tells.

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From an editorial in POWER

THE McGRAW-HILL

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HYDRO, DIESEL, AND GAS TURBINE STATIONS

Deals with central stations other than steam-electric, describing their fundamentals, their distinctive equipment and operations, and their part in the whole electric supply system. You see how various types of hydraulic turbines and gas turbines work, how they are arranged and controlled. Operation, arrangements, and control of internal combustion engines are made plain, along with switching equipment, transformers, voltage regulators, etc.

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Colorado PUC Rules on Depreciation

Public Service Co of Colorado is ordered to normalize taxes and use a restricted surplus method of accounting for tax deferral

The Colorado Public Utilities Commission ruled that Public Service Co of Colorado should normalize taxes and use a restricted surplus method of accounting for the tax deferral arising from the application of Section 167 of the Internal Revenue Code. The accounting order was dated Jan. 5. It should be noted that the company had petitioned for that kind of treatment.

Effect of Fast Depreciation

In its statement, the PUC, after mentioning the fact that the applicant is currently accruing for book depreciation amounts which are approximately equal to that used for tax purposes, went on to say in part that "It is the position of applicant in this matter that the actual effect of the accelerated depreciation . . . does not create a windfall, but simply serves to defer federal income taxes, since the total income taxes over the life of a given item of property are the same (with a constant tax rate), under any of the individual methods permitted by said Section of the Code.

"Applicant takes the above stated position that accelerated depreciation be considered as resulting in a tax deferral rather than a tax saving in view of the assumptions which must be made, all of which must be accepted or materialized, before a contention that tax saving results may be supported.

Tax Saving Assumptions

"The applicant considers such assumptions for a tax savings to be (1) the tax payer makes the same or increasingly larger expenditures for new property each year, (2) the new property has approximately the same composite life expectancy, (3) the provisions of the current Section 167 will continue in effect, (4) the company continues to use the accelerated depreciation, and (5) the tax rate does not change."

The PUC, after noting the company's proposal to normalize taxes and use the restricted surplus method of accounting, said that "The commission has reviewed all the evidence presented by the applicant, the questions raised by the protestant, the questions raised by the commission's staff and summary information supplied by the staff relative to decisions of other state regulatory commissions and the report of the Committee of the National Association of Railroad and Utilities Commissioners on the accounting treatment of tax reduction occasioned by depreciation provisions of Internal Revenue Code of 1954.

Facts of PUC Listed

"Notwithstanding the evidence presented in this case and other information available representing the thinking on this subject, certain facts appear to stand out as being fundamental in nature on which the commission must stand. These quite apparent facts are: (1) The actual effects of the application of liberalized depreciation as provided in Section 167 of the Internal Revenue Code are historically unknown at this time; (2) the application of liberalized depreciation, as permitted under Section 167, may extend over the service lives of depreciable property much of which may range around 30 years in contrast to the situation with regard to the five-year amortization provided under Section 168 of the Internal Revenue Code of 1954: (3) **under certain combination of factors, outlined in the assumptions set forth earlier herein, the case of liberalized depreciation may result in actual tax savings and not in mere deferment of payment of tax (Emphasis supplied).**

"In view of these facts and the indeterminate possibilities of the ultimate effect of the utilization of the liberalized depreciation under Section 167, this commission is of the opinion the public interest will best be served by causing the company to record on its books amounts representing the difference in taxes computed by using the liberalized method elected by the company under Section 167, as set forth in the general method of accounting requested by applicant.

"No one at this moment can say positively that the use of liberalized depreciation will result in what would amount to tax deferral or tax saving and therefore this commission holds that the proposed accounting by applicant should not bind this commission in any way as to future treatment for rate making purposes the funds which will be accounted for in the account entitled 'Earned Surplus Restricted for Future Federal Income Taxes.' The funds so accounted for in this restricted surplus account shall, of course, not be available for dividends.

"The commission is of the opinion that the order sought by applicant should be granted."

Commissioner John P. Thompson, who, while agreeing with the majority of the commission as to the need to normalize taxes, was in dissent as to the balance sheet treatment of the deferral. He felt that since it was agreed that a future liability was being incurred by the deferral of taxes then a reserve method of accounting should be used.

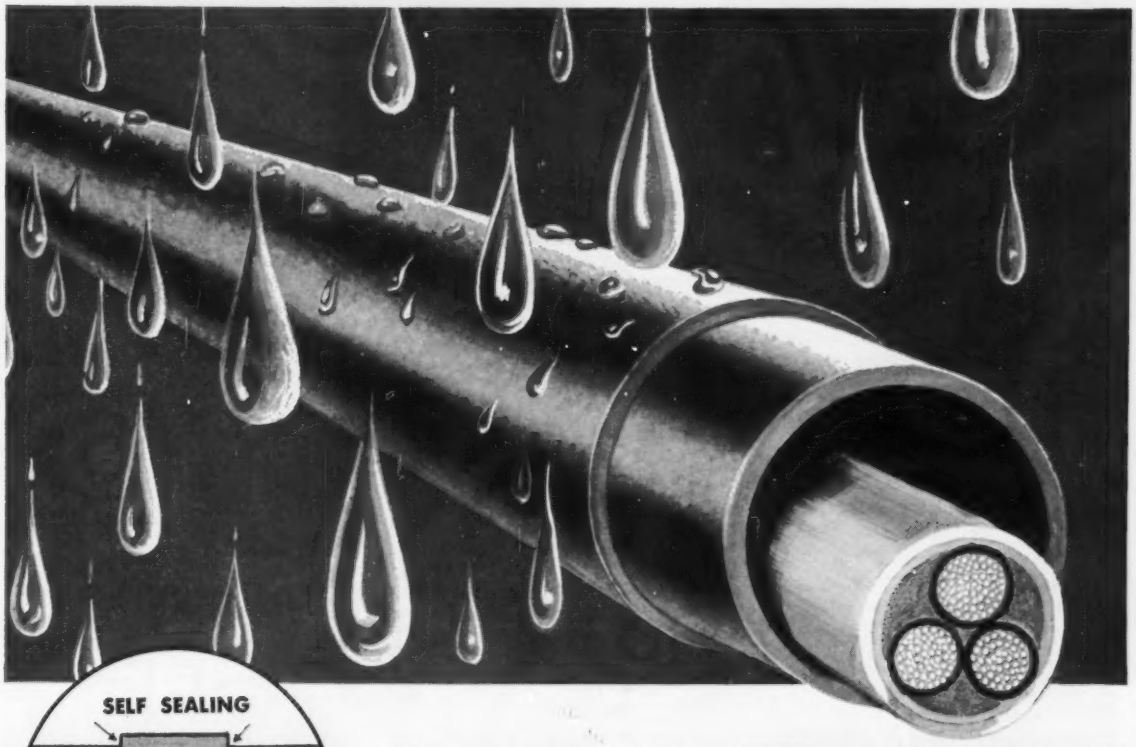
PSC Will Determine Fair Value, Court Rules

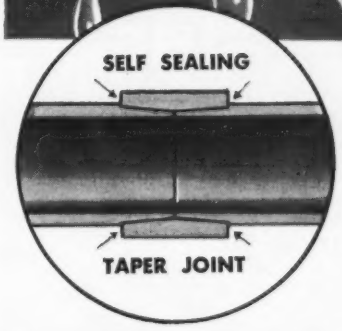
Arizona's Supreme Court ruled recently that the State Corporation Commission, for rate making purposes, has the right to determine the fair value of a utility, so long as the commission's action is not "capricious" or without basis.

A unanimous decision written by Justice Dudley W. Windes held that the courts have only the power of review of the commission's action and cannot change the rate base set by the commission.

The decision added, however, that the courts can order the commission to reconsider a previous rate-making

WATERTIGHT!





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action if they find the commission erred in its original findings.

The ruling was made by the high state court in upholding a commission-ordered rate reduction of more than $10,000 a year for the Round Valley Light & Power Co.

In the Round Valley case, the commission held in November, 1953, that the cooperative was making 11.91% return on its rate base (equipment and plant value) of $136,667. The commission cut the utility's annual net revenues to about $9,600, or 7.1% of its rate base.

Round Valley appealed the order to Maricopa County Superior Court, where Judge Ralph Barry held that the value of plant and equipment, allowing for replacement at present day cost, was $205,070. This according to the court, would give the utility a return of 7.28%.

While the high court did not answer what constitutes fair value, it nevertheless held that the courts cannot weigh the evidence (testimony and exhibits about assets) "and make a finding of fair value." The court said that "By the constitution, this function is delegated exclusively to PUC."

FINANCIAL BRIEFS

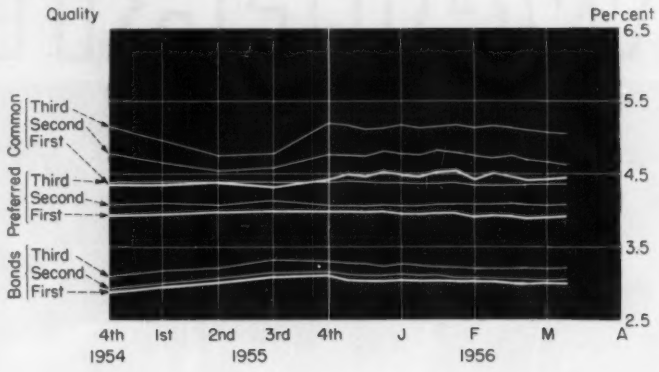
Higher Common Stock Dividends—St. Joseph Light & Power Co will pay March 28 a quarterly common stock dividend of 35¢ a share as compared with 33¢ a share in the previous quarter. . . Delaware Power & Light Co will pay April 30 a quarterly common stock dividend of 40¢ a share versus 37½¢ a share previously.

American Gas & Electric Co is planning to split its common stock on the basis of three shares for each two shares now held.

Lowell Electric Light Co is planning to sell $6 million of debentures to the First National Bank of Boston. They will be due in three years and will carry an interest rate of 3½% in the first year and 3¾% thereafter.

Southern Indiana Gas & Electric Co commonholders subscribed for 77,685 shares on a 1-for-10 basis at $28.50. Balance 5,345 shares were taken by the underwriters headed by Smith, Barney & Co.

Today's Utility Yields (%)



	BONDS			PREFERRED STOCKS			COMMON STOCKS		
Quality	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Mar. 8	3.02	3.07	3.21	3.94	4.10	4.39	4.46	4.61	5.06
Mar. 1	3.02	3.06	3.20	3.93	4.09	4.38	4.45	4.69	5.08

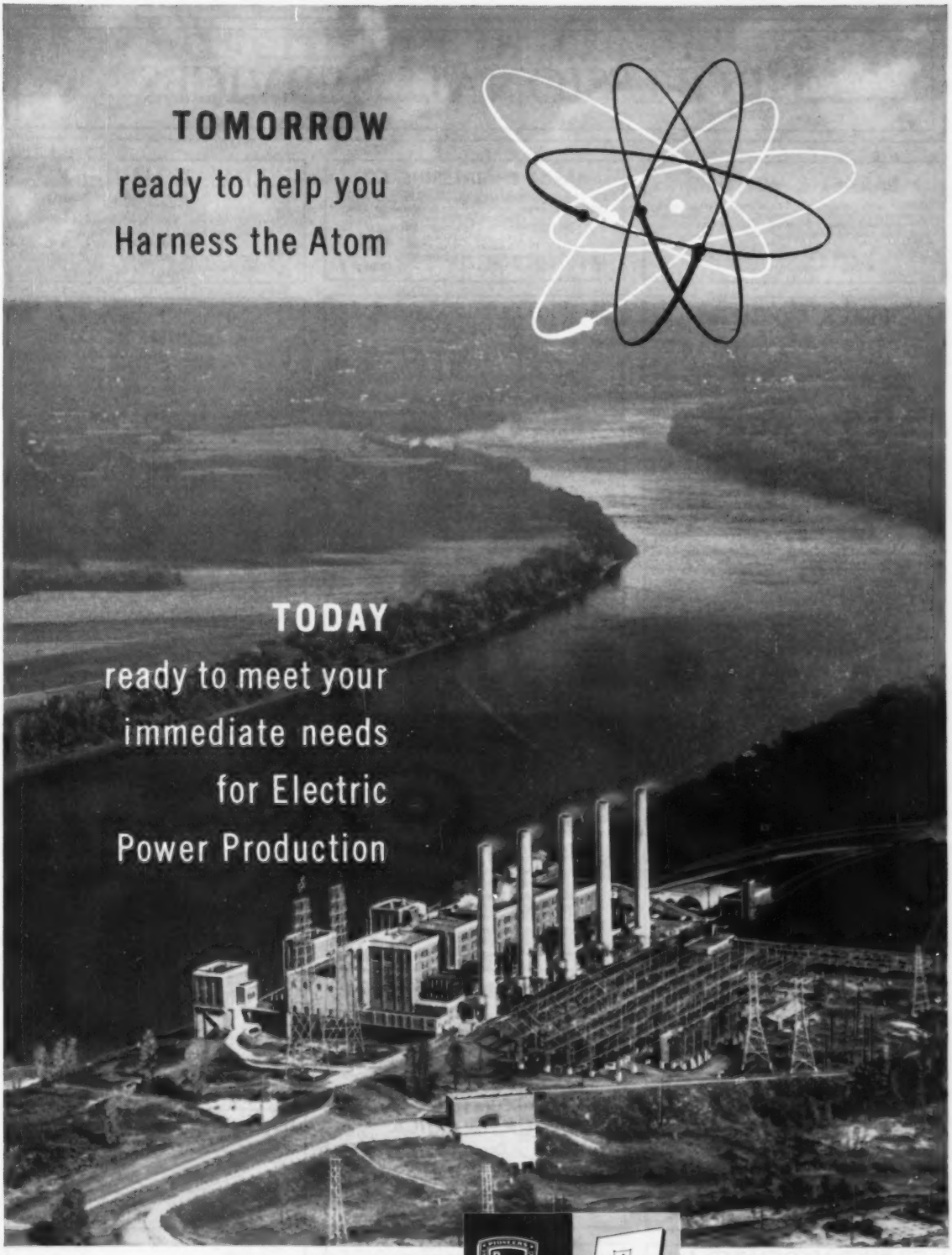
Utility Earnings

COMPANY	PERIOD MONTHS ENDED		NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
Atlantic City Electric	12	Dec.	$4,396,127	$3,907,497	$1.54	$1.41
Central Illinois Light	12	Dec.	4,202,307	3,535,701	3.70	3.03
Connecticut Light & Power	12	Dec.	9,104,871	9,083,407	1.10(a)	1.17(a)
Consumers Power	12	Dec.	29,035,909	26,551,696	3.18(a)	2.95(a)
Dayton Power & Light	12	Dec.	9,580,000	8,439,000	3.30(b)	2.88(b)
Hartford Electric Light	12	Dec.	4,297,161	3,692,950	4.17	3.54
Interstate Power	12	Dec.	2,861,717	2,592,781	1.00	0.96
Iowa-Illinois Gas & Electric	12	Dec.	4,841,456	4,462,226	2.32	2.12
Kansas Power & Light	12	Dec.	5,588,507	5,152,659	1.73	1.56
Kentucky Utilities	12	Dec.	5,838,591	5,690,472	1.97(b)	2.07(b)
Long Island Lighting	12	Dec.	11,065,000	9,242,000	1.41(a)	1.29(a)
Louisville Gas & Electric	12	Dec.	7,041,502	6,105,263	3.59(b)	3.35(b)
Montana-Dakota Utilities	12	Dec.	3,386,065	3,177,208	1.46	1.36
Northern Indiana Public Service	12	Dec.	11,529,000	10,139,000	2.73(b)	2.45(b)
Puget Sound Power & Light	12	Dec.	4,924,981	4,461,331	1.51	1.37
Quebec Power	12	Dec.	1,153,882	1,038,229	1.73(b)	1.78(a)
Southern Indiana Gas & Electric	12	Dec.	2,455,037	2,468,093	2.24	2.25
Wisconsin Power & Light	12	Dec.	5,869,000	5,218,000	1.72(b)	1.68(b)

Notes—All the figures shown above have been audited; (a) Based on average shares outstanding; and (b) Based on shares outstanding at end of the year.

Utility Financing

COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
MARCH 8-14			
COMMON STOCK			
Oklahoma Gas & Electric—298,479 sh (being offered commonholders on 1-for-10 basis, record Mar. 8 to expire Mar. 27)	$10,148	$34.00	5.00%
SCHEDULE FOR MARCH			BID DATE
BONDS			
Alabama Power—1st mtg due 1986	$14,000	.....	Mar. 15
Narragansett Electric—1st mtg due 1986	10,000	.....	Mar. 20
Pacific Gas & Electric—1st mtg due 1986	25,000	.....	Mar. 20
Georgia Power—1st mtg due 1986	12,000	.....	Mar. 29
PREFERRED STOCK			
Louisiana Power & Light—70,000 sh $100 par	$7,000	.....	Mar. 20



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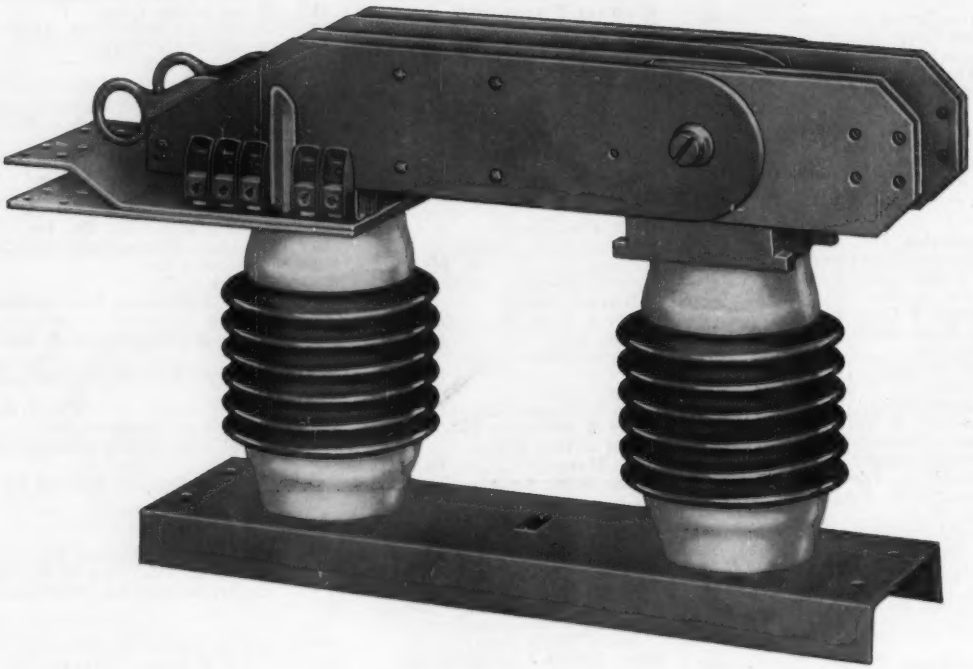

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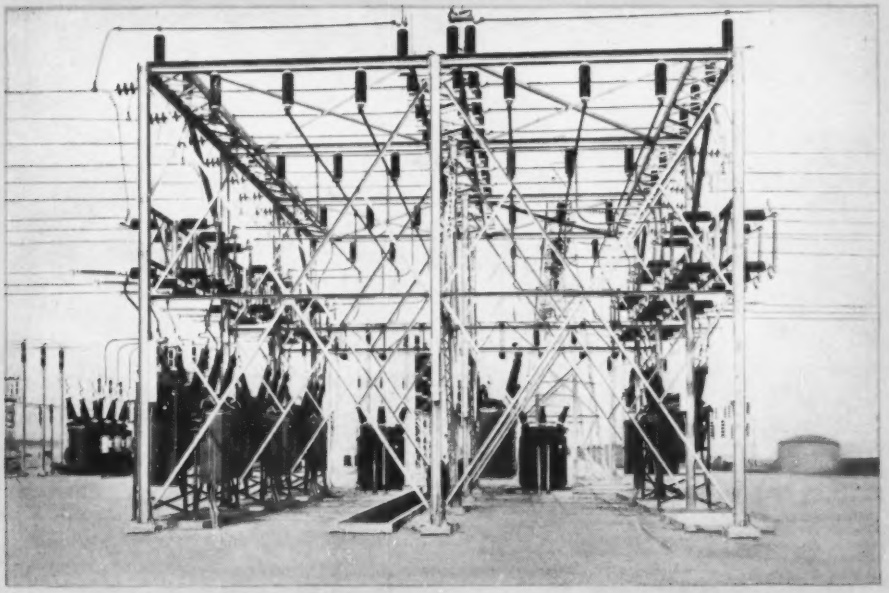

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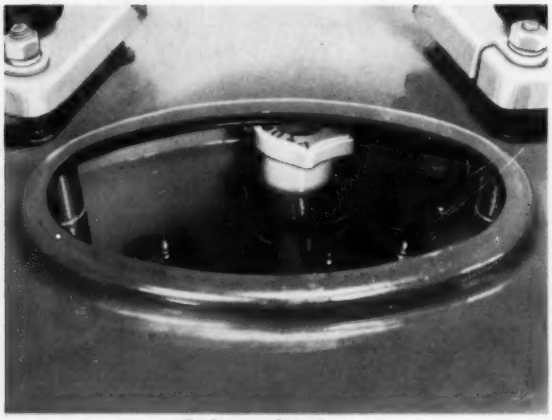

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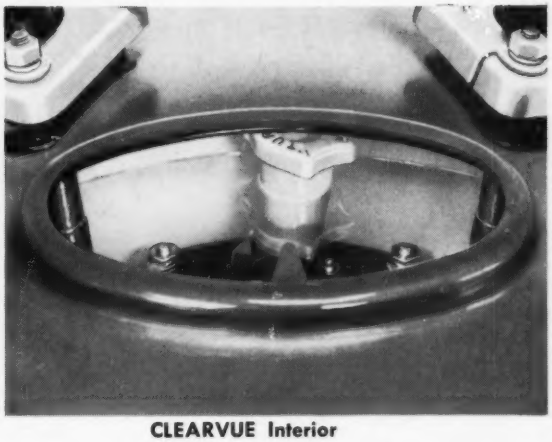

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